OPTIMAL JOINT PROGRAM ELECTION IN STACKED INCOME PROTECTION PLAN FOR UPLAND COTTON PRODUCERS IN TEXAS

A Thesis

by

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ABSTRACT

To achieve the goal of the 2014 Farm Bill, many programs (direct payments, counter-cyclical payments, and ACRE) that relied on market trends were replaced with other types of risk management tools. Upland cotton producers now have the option between two new risk management programs, Stacked Income Protection Plan (STAX) and Supplemental Coverage Option (SCO). The objective of this research is to examine the new STAX and SCO programs to understand their effects on producers' decisions to elect to enroll in the programs as a risk management tool. To analyze these new programs, a simulation model was built using the Excel add-in Simetar©. Fifty-eight scenarios were developed based on the STAX and SCO parameters to analyze the risk ranking preferences and optimal rate of additional coverage for a producer.

The model resulted in several conclusions. Irrigated cotton production receives higher program net indemnities than non-irrigated due to irrigated cotton being a higher valued crop. STAX is preferred more often than SCO. Texas farms received higher probabilities of a positive program net indemnity more frequently than Arkansas from STAX and SCO. Risk averse decision-makers prefer to purchase lower and cheaper individual coverage with a subsidized companion policy that allows for the greatest indemnification of remaining liability on their cotton crop.

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CHAPTER I

INTRODUCTION

As expiration of the Food, Conservation, and Energy Act of 2008 neared, lawmakers disagreed on a bi-partisan 2012 Farm Bill for a multitude of reasons: these include program costs, inclusion of nutrition programs, and level of federal support. Eventually, the 2008 Farm Bill was extended through the American Tax Payer Relief Act of 2012; so that current agricultural, nutrition, and food assistance programs would not expire and revert back to the laws in the Agricultural Act of 1949. Much of the debate preventing passage of the Farm Bill was the cost. During a time, when the federal government was having extreme budget reductions, the American public wanted to know why agriculture received 34 percent of the total 2008 Farm Bill. Public opinion perceived that the American government used taxpayer dollars to subsidize agriculture. Cost estimates from the previous Farm Bill (2008) including: commodity programs, conservation programs, crop insurance programs, trade programs, new horticulture and organic spending, and supplemental disaster assistance was projected at $201.2 billion for the entirety of the bill (Economic Research Service, 2013). However, this is less than half of what was spent on nutrition and food supplement programs; the other portion that constitutes the Farm Bill and its respective budget estimated at $442 billion. As lawmakers continued discussions on how to structure commodity programs in the new Farm Bill, they needed a solution that continued to mitigate risk to the producer, but also cut direct assistance from the government to aid in budget reductions. Commodity groups and lawmakers saw that crop insurance could play a pivotal role in the current farm bill and beyond (Collins and Bulut, 2011). Two programs that were added to the Farm Bill package were insurance based programs for cotton: Stacked Income Protection Plan (STAX) and Supplemental Coverage Option (SCO).

Insurance markets are typically suited for risk that are not correlated, occur with high frequency, and have a large number of participants with few other systematic characteristics (Woodard et al., 2012). At its very core, agriculture defies the systematic characteristics of an insurance market because many of the extreme and disastrous events (crop failure) in agriculture are indeed correlated. This correlation is caused by widespread weather events – hail, drought, flooding, and large storm systems that produce damaging winds or tornadoes. Nevertheless, lawmakers and commodity groups agreed that crop insurance could be a solution that allows a manageable amount of risk to be transferred to producers, but provide assistance through subsidized premiums for additional coverage.

Prior to the 2014 Farm Bill, upland cotton producers achieved risk management two ways: crop insurance and farm programs (direct and counter-cyclical payments). However, when the debate for a new Farm Bill arose, the National Cotton Council and lawmakers proposed a new program for upland cotton producers – Stacked Income Protection Plan (STAX). STAX is a shallow loss, area-wide revenue insurance. The program allows producers to lose a small percentage (ten percent) of revenue before the program takes effect; the program does not insure 100 percent of the producer's revenue. Upland cotton producers enrolled in a crop insurance program can "buy-up" additional coverage through STAX at a subsidized rate to insure their upland cotton acres at a higher coverage to continue greater risk management. STAX replaced direct and counter-cyclical payments, and instead producers receive a subsidy at 80 percent of their premium on their “buy-up” coverage. As revenue insurance (STAX) became the mainstream for risk management in upland cotton production.

The passage of the 2014 Farm Bill also introduced Supplemental Coverage Option, this is an additional insurance option that should not be confused with a commodity program. Upland cotton producers not enrolled in STAX can elect to enroll in SCO. This insurance plan is another form of “buy-up” coverage in addition to a producer’s individual policy. The trigger level is 86 percent. If revenue/yield falls below the 86 percent trigger level, then the producer will receive an indemnity.

The objective of this research is to examine the STAX and SCO programs and understand their effects on producers’ decisions to elect to enroll in the programs as a risk management tool. Analysis of a representative farm in the Coastal Bend Region of Texas demonstrated that changes in SCO, STAX, and crop insurance can have various effects on program cash flow income (Knapek, 2013). Knapek (2013) found that a farm could benefit from buying STAX and lowering its level of crop insurance, but he suggested that the optimal risk management package will vary from farm to farm.

CHAPTER II

LITERATURE REVIEW

When the 2014 Farm Bill debate began in 2012, many (producers, lawmakers, lenders, insurers) speculated as to what would be the next “it” policy tool or safety program for agriculture. To understand this debate, we must acknowledge the financial crisis the U.S. was in at the time. The national debt ceiling and government sequestration was a key player in determining the monetary support available for agriculture. With a $13 trillion national deficit, how was the government going to continue to provide assistance to agriculture? The championed idea and policy was crop insurance. Crop insurance was revered as the “new kid” on the playground with the hopes of being the next most valuable player in agricultural policy. However, crop insurance has been a part of the agricultural policy toolbox for decades. Undoubtedly, the 2014 Farm Bill has helped accelerate crop insurance into the national spotlight as a management tool.

History of Crop Insurance

In 1938, Congress created the federal crop insurance program through the authorization of the Federal Crop Insurance Corporation. Initially the program started as an experiment, and its activities were limited to major crops in the main production areas (RMA, 2009). The crop insurance experiment was established because the government and rural Americans needed a mechanism to address the effects of both the Great Depression and Dust Bowl. For much of the early to mid-twentieth century crop insurance was a policy tool, but was not widely used or available.

The federal crop insurance program's current structure began with the passing of the Federal Crop Insurance Act of 1980; and it was not until then that crop insurance began forward progress and adoption. The Act of 1980 expanded the program allowing additional participation by producers in various regions. With expansion of the program, this established crop insurance as the primary form of disaster protection for agriculture producers, replacing the standing disaster assistance program with subsidized crop insurance (Glauber, 2004). To encourage participation in the program, the Act of 1980 authorized that premiums be subsidized – the subsidy was equal to thirty percent of the crop insurance premium limited to the dollar amount at 65 percent coverage (RMA, 2009). Premium subsidies did increase producer participation; however, not to the level that Congress had anticipated.

In 1994, to reach the desired level of participation, Congress made it mandatory to enroll in the crop insurance program. If producers did not enroll in the program, they would forfeit eligibility for certain financial and disaster supports. Over the years, subsidies have increased so the insurance programs appear more attractive and encouraged purchases. In 1980, subsidies were thirty percent of the premium and today subsidies can be as much as eighty percent. The mandatory enrollment of 1994 did achieve its purpose of introducing and educating producers to the program, and participation has continued to increase through the years. In 1996, Congress repealed the mandatory enrollment, but if producers accepted other Farm Bill benefits they were and still are required to purchase crop insurance.

Crop insurance is managed as a public-private partnership. Private companies are charged with the delivery and sale of insurance to producers, and the government helps fund the administrative and overhead cost. Both parties share the responsibility and risk of underwriting the contracts. If the public-private partnership did not exist the crop insurance program would not exist. Contracts for crop insurance and agricultural products would be too costly (and risky) for an insurance company to underwrite; and too expensive for producers to purchase.

Since its inception, the Federal Crop Insurance Corporation has grown tremendously. For the 2012 crop year, there were 1.17 million policies that insured 282 million acres – the value of those acres equaled $117 billion. The number of policies and acres translate into $11.1 billion in premiums and nearly $117 billion in liability (Sheilds, 2012).

Role of Crop Insurance

Historically, crop insurance was largely utilized as yield insurance. A producer could insure their crop at a certain percentage level of coverage, and if their yield was lower than historical yield times the coverage level, then they would receive an indemnity payment. In the beginning, yield insurance began as individual farm-yield polices, but individual policies have two major problems (a) moral hazard and (b) high administrative cost.

Harold Halcrow (1949) introduced an alternative insurance policy in the form of an area-yield plan. Halcrow explains how area-yield plans would operate, "premiums and indemnities are based on the yield received in an area of normally uniformed crop conditions…Indemnities are paid to any insured farmer in any year in which the mean area-yield for the year falls below a specified level." The success of area-yield plans is "normally uniformed crop conditions", in agriculture this is not always the case. However, studies (Halcrow, 1949; Miranda, 1991, Barprogramt et al 2005) do indicate that area-yield insurance provides just as much if not better risk reduction to farmers than farm-yield (individual) policies.

While area-yield plans have their advantages (generally more readily available data, cheaper administrative cost, and moral hazard disappears because of equal information) these type of plans do have a major limitation in trying to manage risk. Area-yield plans only insure part of the risk equation that producers face – yield. The other variable of the risk equation is market volatility (prices); making revenue risky. As a result of recognizing that agricultural risk is comprised of two components (price and yield) several revenue policies became available. In 1996, with the passage of the U.S. Federal Agricultural Improvement and Reform Act, the Risk Management Agency (RMA) introduced Income Protection (IP) and two private insurance contracts became available: Crop Revenue Coverage (CRC) and Revenue Assurance (RA).

Woodard, Sherrick, and Schnitkey define revenue risk in their 2010 paper: a producer's revenue distribution results from price and yield variability for the crops produced, and correlations between prices and yields. One of their findings was that actual production history (APH) insurance alone does not appear very effective as a risk management tool. This is not surprising as APH only insures yield.

Miranda and Glauber (1991) proposed an area revenue program that would indemnify producers when the area revenue fell below the target revenue in that producer's region. The study verified an area revenue program can provide improved revenue protection, and that county target revenues do provide individual revenue protection. The study examined homogenous yields in the Midwest, and Miranda and Glauber expressed additional work should be conducted on other program crops; especially Texas as it failed to show improvement under a target revenue program.

Several years later, IGF Insurance Company developed an area revenue plan called Group Risk Income Protection (GRIP). This policy pays an indemnity when the county average revenue falls below the selected trigger level. The creation of GRIP expanded the participation of producers to enroll in area revenue insurance, as demonstrated by their increased participation, and recognizing that an area plan offers sufficient risk management benefits (Paulson and Babcock, 2008).

As one reads through the literate on crop insurance it will be noticed that much of the literature is limited by two factors: crop and region. The majority of crop insurance papers focus on corn and/or soybeans, and is limited to a specific region – the Midwest (Paulson and Babcock, 2008; Sherrick et al., 2004; Woodard, Sherrick, and Schnitkey, 2010). Honestly, the entire page could be filled with citations from papers that focused on corn and/or soybeans in the Midwest. Corn and soybeans production in the Midwest is very different from upland cotton production in Texas. Farm yields in the Midwest are very homogenous and correlates very well to area yield data. However, upland cotton yields in Texas vary greatly from farm to farm, making area-wide plans less effective in reducing risk.

While the literature for crop insurance is quite expansive, it is clear that there is room for additional work to be continued on the new policies that have just been passed in the 2014 Farm Bill. STAX and SCO are brand new policies, and there is little for producers to reference for guidance in how to best select the correct risk management program for their farm. Additionally, even less of the literature focuses on cotton in the Southern United States. Texas is the largest producing cotton state in the US. Upland cotton producers will need and want to understand how STAX and SCO can benefit them in terms of managing their revenue risk.

CHAPTER III

METHODOLOGY

A Monte Carlo or stochastic model was built to determine the best scenario for the key output variable (KOV), program net indemnity, on cotton farms. Specifically, SIMETAR© an Excel add-in was used to construct the stochastic model (Richardson, Schumann, and Feldman, 2005). Stochastic modeling and simulation is attractive because it allows for better understanding of the lower and upper tails (extreme or rare possibilities) of an event; stochastic procedures can more effectively handle problems associated with skewed distributions (Lemieux, Richardson, and Nixon, 1982). When analyzing a producer's risk aversion, researchers use stochastic simulation to estimate distributions for key output variables that can be ranked using risk ranking techniques such as: stochastic dominance and stochastic efficiency (Goodwin, Vandeveer, and Deal, 2004; and Barham et al., 2011).

Simulation

Simulation is used for risk analysis to estimate distributions of economic returns for alternative strategies, and is "solved" a large number of times to statistically represent all possible combinations of the random variables in the system (Richardson, 2010). The risky or exogenous variables in this model are price and yield.

Price and yield are risky because these are the two variables the producer cannot control. To help minimize risk, the two variables were simulated to better understand the probability for outcomes of the lower tails. Through the simulation process, many possible outcomes are chosen at random to re-create the probability distribution functions (pdf) of the variables – price and yield. Understanding the uncertainty of price and yield allows for better risk management of the KOV – program net indemnity.

In this model, price, farm yield, and Moore County yield data were simulated using a multivariate empirical (MVEMP) distribution method first introduced by Richardson and Condra in 1978. A MVEMP distribution was utilized because the distribution allows for two or more correlated random variables that are not normally distributed to be simulated. Price data was simulated using futures pricing data for the planting price, and national marketing prices from the Food and Agricultural Research Institute (FAPRI) at the University of Missouri were used for the mean harvest price of 2015. The national marketing year price (FAPRI) was adjusted, by adding the basis to the national mean, to ensure that price at harvest accounted for geographic location and points of delivery. The FAPRI prices are updated periodically, and can be added to the model as needed. The stochastic price data was simulated for the 2015 program year for 500 iterations. Farm yield data for each representative farm in the respective county was simulated in a similar fashion. The stochastic data (price and farm yield) were derived from their respective historical data going back ten years (2003 – 2012). While additional years of historical data are always optimal, ten years was sufficient for this research, and data past the ten year mark was not consistent for all counties.

Fortunately, county yield data has a more extensive history, and the county yield data used was from 1981 to present. A spline regression was used to remove the systematic risk in the county yield data (Crosby, Dawson, Hill and Mississippi). Moore

County was not included in this method because it has little historical data, resulting in less risk of reported yields over its 10 year time period. The residuals from the spline regression were then used as the risk encountered by county yields, allowing for a better fit.

Data

Texas represents a unique opportunity to analyze STAX and SCO for upland cotton producers for three reasons: 1) Texas is the largest state producing upland cotton and would logically have a large volume of insurance contracts, 2) geographically – its diverse production practices (dryland vs. irrigated), and 3) distance from Memphis, Tennessee – the Memphis Cotton Exchange governs the mid-south cotton production and is the largest spot cotton market in the world. To encompass the diversity of cotton production and practices in Texas, four representative farms located in different counties of Texas will be utilized for this analysis - Crosby, Dawson, Hill, and Moore. In conjunction with examining the programs for Texas, a representative farm from Mississippi County, Arkansas will be included for analysis. Incorporating the representative farm from Arkansas allows for a deeper understanding of how the basis and spot price will affect these new farm programs. Mississippi County, Arkansas has virtually a zero basis because of its proximity to the Memphis Cotton Exchange, approximately 60 miles. Additionally, the representative farm from Arkansas allows for comparison of the programs from one state to another.

Data that define the five representative farms selected for this study are managed and maintained by the Agricultural and Food Policy Center (AFPC) at Texas A&M

University. A representative farm mimics a farming operation in its locale, and is created through the use of a panel, which consists of several top producers in the county; the data collected from the panel is "representative" of farming operations in the county (AFPC, 2014).

- *Crosby County – On the Eastern Caprock of the Texas South Plains is a large cotton farm. Cotton accounts for 4,150 acres annually (2,050 dryland and 2,100 irrigated). The remainder of the acres are planted in sorghum (550 acres) and wheat (300 acres). The majority, 86 percent, of farm receipts are from cotton.*
- *Dawson County – Located in the Texas South Plains is a 4,500 large sized cotton farm that grows 4,047 acres of cotton (2,667 dryland, 1,380 irrigated). Cotton sales are 97 percent of the farm receipts, the remaining three percent are wheat.*
- *Hill County – Located in Northern Central Texas is a moderate size farm with 2,500 total acres. The farm has 300 acres of dryland cotton.*
- *Moore County – In the Panhandle of Texas, sits a large cotton farm with 8,000 acres. The 8,000 acre farm has 3,200 irrigated cotton acres and 800 dryland cotton acres.*
- *Mississippi County, Arkansas – Far Northeast Arkansas located near the Mississippi River is a 5,000 acre cotton farm. All acres are planted in cotton, therefore, all receipts to the farm are from cotton.*

The five representative farms provide actual historical production yield data that is characteristic of the five locations. County yield data will be obtained from the National Agricultural Statistics Service (NASS). Location diversity allows for a better understanding of how production practice (irrigated vs. non-irrigated) affects the KOV and ultimately the producer's decision to enroll in the new area-wide companion programs (STAX and SCO).

Overview of Model

Richardson (2010) has designed a best management practice for developing models; develop from the top down. A modeler needs to think of the entire system and what the key output variables (KOVs) are for the model. While the model is developed from the top down with the output variables, the model is built from the bottom up starting with historical data and stochastic variables. The following discusses in depth how this model was built with focus on the KOV – program net indemnity.

Data for the model were collected from various sources: NASS, AFPC representative farms, futures market, and FAPRI. Data were grouped into their respective regions/counties, each group contained the following fields: county yield, farm yield, planted county yield, futures at planting, and national market price adjusted for basis at harvest. The data were further refined based on production practice – irrigated and non-irrigated. However, this was not the case for Hill County as it only produces non-irrigated (dryland) cotton in this region. Summary statistics were calculated for each variable, returning the minimum, maximum, mean, standard deviation, lower and upper confidence intervals, skewness, and kurtosis of the original data.

Simple trend regressions were calculated for each variable: county yield (dryland and irrigated), farm yield (dryland and irrigated), planted county yield (dryland and irrigated), futures at planting, and futures at harvest (adjusted for basis) to find the slope, intercept, and trend. Trend was determined by evaluating the T-test and Prob(T). All Texas representative farms exhibited zero trend for yields; this was expected as Texas yields are unpredictable from year to year because of wide-ranging weather. Mississippi County located in Arkansas did exhibit trend in four variables – county yield (dryland), farm yield (dryland and irrigated), and futures prices at planting; as indicated by the T-test being less than .05. The summary statistics and ordinary least squares regression for each county are presented in Tables 1 - 5.

Table 1. Crosby County Summary Statistics & OLS Regression

Summary Statistics

	Farm Yield - Non (2003 - 2012)	Farm Yield - Irr. (2003 - 2012)	Co. Yield - Irr. Spline 1 (1981 - 2003)	Co. Yield - Irr. Spline 2 (2004 - 20012)	Co. Yield - Non. Spline 1 (1981 - 2003)	Co. Yield - Non. Spline 2 (2004 - 2012)	F @ Planting (2003 - 2012)	F @ Harvest (2003 - 2012)
Mean	256.700	776.500	412.527	845.780	234.638	362.064	71.605	68.946
StDev	218.521	288.314	130.676	91.430	70.095	165.391	22.218	27.522
95 % LCI	74.701	536.372	347.190	769.631	199.591	224.315	53.100	46.023
95 % UCI	438.699	1016.628	477.864	921.930	269.685	499.814	90.110	91.868
Min	0.000	239.000	135.306	712.038	101.325	138.036	51.145	42.372
Median	270.500	869.500	414.545	813.570	232.599	316.228	63.569	65.237
Max	665.000	1055.000	615.727	978.641	338.369	636.464	123.006	132.318
Skewness	0.511	-0.850	-0.535	0.315	-0.263	0.390	1.581	1.521
Kurtosis	-0.337	-0.440	-0.050	-1.252	-1.060	-1.018	2.461	2.409

OLS Regression

	Farm Yield - Non (2003 - 2012)	Farm Yield - Irr. (2003 - 2012)	Co. Yield - Irr. Spline 1 (1981 - 2003)	Co. Yield - Irr. Spline 2 (2004 - 20012)	Co. Yield - Non. Spline 1 (1981 - 2003)	Co. Yield - Non. Spline 2 (2004 - 2012)	F @ Planting (2003 - 2012)	F @ Harvest (2003 - 2012)
Intercept	32315.867	36412.667	-10888.679	-933.738	6311.676	42474.870	-9661.906	-9575.067
Slope	-15.970	-17.752	5.673	0.886	-3.051	-20.964	4.849	4.804
R-Square	0.049	0.035	0.087	0.001	0.087	0.189	0.437	0.279
F-Ratio	0.412	0.288	1.994	0.009	2.004	1.859	6.198	3.100
Prob(F)	0.539	0.606	0.173	0.927	0.171	0.210	0.038	0.116
S.E.	24.885	33.078	4.018	9.432	2.155	15.378	1.948	2.728
T-Test	-0.642	-0.537	1.412	0.094	-1.416	-1.363	2.490	1.761
Prob(T)	0.537	0.605	0.172	0.927	0.171	0.206	0.034	0.112

Table 2. Dawson County Summary Statistics & OLS Regression

Summary Statistics	Farm Yield - Non (2003 - 2012)	Farm Yield - Irr. (2003 - 2012)	Co. Yield - Irr. Spline 1 (1981 - 2003)	Co. Yield - Irr. Spline 2 (2004 - 20012)	Co. Yield - Non. Spline 1 (1981 - 1988)	Co. Yield - Non. Spline 2 (1989 - 2001)	Co Yield - Non. Spline 3 (2002 - 2014)	F @ Planting (2003 - 2012)	F @ Harvest (2003 - 2012)
Mean	163.300	827.900	554.711	995.465	272.411	249.940	300.454	71.605	68.946
StDev	130.647	272.430	172.130	154.393	132.533	123.075	179.571	22.218	27.522
95 % LCI	54.488	601.002	468.648	857.282	143.482	130.212	125.766	53.100	46.023
95 % UCI	272.112	1054.798	640.774	1133.647	401.341	369.669	475.143	90.110	91.868
Min	0.000	515.000	144.000	686.355	81.117	50.192	80.686	51.145	42.372
Median	212.500	775.000	566.733	1010.017	285.009	247.245	278.196	63.569	65.237
Max	331.000	1375.000	847.059	1200.000	480.888	427.504	531.502	123.006	132.318
Skewness	-0.319	1.096	-0.283	-0.747	0.039	-0.119	0.144	1.581	1.521
Kurtosis	-1.816	0.644	-0.018	0.927	-0.439	-0.432	-1.573	2.461	2.409

OLS Regression	Farm Yield - Non (2003 - 2012)	Farm Yield - Irr. (2003 - 2012)	Co. Yield - Irr. Spline 1 (1981 - 2003)	Co. Yield - Irr. Spline 2 (2004 - 20012)	Co. Yield - Non. Spline 1 (1981 - 1988)	Co. Yield - Non. Spline 2 (1989 - 2001)	Co Yield - Non. Spline 3 (2002 - 2014)	F @ Planting (2003 - 2012)	F @ Harvest (2003 - 2012)
Intercept	38281.467	-83620.933	-31087.494	41305.054	-16592.099	40003.599	16180.211	-9661.906	-9575.067
Slope	-18.988	42.067	15.885	-20.071	8.498	-19.946	-7.917	4.849	4.804
R-Square	0.194	0.219	0.392	0.182	0.025	0.335	0.032	0.437	0.279
F-Ratio	1.921	2.238	13.525	1.554	0.152	5.539	0.293	6.198	3.100
Prob(F)	0.203	0.173	0.001	0.253	0.710	0.038	0.601	0.038	0.116
S.E.	13.700	28.122	4.319	16.100	21.815	8.475	14.625	1.948	2.728
T-Test	-1.386	1.496	3.678	-1.247	0.390	-2.354	-0.541	2.490	1.761
Prob(T)	0.199	0.169	0.001	0.248	0.708	0.036	0.600	0.034	0.112

Table 3. Hill County Summary Statistics & OLS Regression

Summary Statistics	Farm Yield - Non (2003 - 2012)	Co. Yield - Non. Spline 1 (1981 - 1986)	Co. Yield - Non. Spline 2 (1987 - 2006)	Co Yield - Non. Spline 3 (2007 - 2014)	F @ Planting (2003 - 2012)	F @ Harvest (2003 - 2012)
Mean	386.800	423.292	442.413	563.253	71.605	68.946
StDev	82.963	169.714	129.609	178.803	22.218	27.522
95 % LCI	317.703	217.606	372.188	346.550	53.100	46.023
95 % UCI	455.897	628.978	512.639	779.956	90.110	91.868
Min	273.000	239.370	212.093	282.000	51.145	42.372
Median	397.000	364.847	426.667	617.000	63.569	65.237
Max	501.000	665.000	729.000	742.857	123.006	132.318
Skewness	-0.231	0.657	0.766	-0.832	1.581	1.521
Kurtosis	-1.461	-1.460	0.854	-0.672	2.461	2.409

OLS Regression	Farm Yield - Non (2003 - 2012)	Co. Yield - Non. Spline 1 (1981 - 1986)	Co. Yield - Non. Spline 2 (1987 - 2006)	Co Yield - Non. Spline 3 (2007 - 2014)	F @ Planting (2003 - 2012)	F @ Harvest (2003 - 2012)
Intercept	-33217.533	-164603.086	-17362.859	49306.869	-9661.906	-9575.067
Slope	16.739	83.200	8.918	-24.257	4.849	4.804
R-Square	0.373	0.841	0.166	0.064	0.437	0.279
F-Ratio	4.763	21.182	3.575	0.275	6.198	3.100
Prob(F)	0.061	0.010	0.075	0.627	0.038	0.116
S.E.	7.670	18.077	4.717	46.223	1.948	2.728
T-Test	2.182	4.602	1.891	-0.525	2.490	1.761
Prob(T)	0.057	0.006	0.074	0.622	0.034	0.112

Table 4. Moore County Summary Statistics & OLS Regression

Summary Statistics	Farm Yield - Non. (2003 - 2012)	Farm Yield - Irr. (2003 - 2012)	County Yield - Non. (2003 - 2012)	County Yield - Irr. (2003 - 2012)	F @ Planting (2003 - 2012)	F @ Harvest (2003 - 2012)
Mean	366.774	509.966	335.500	991.900	71.605	68.946
StDev	207.729	178.774	268.081	151.468	22.218	27.522
95 % LCI	193.763	361.070	112.224	865.747	53.100	46.023
95 % UCI	539.786	658.862	558.776	1118.053	90.110	91.868
Min	106.667	130.000	0.000	829.000	51.145	42.372
Median	330.517	550.375	371.500	960.000	63.569	65.237
Max	640.000	673.247	758.000	1294.000	123.006	132.318
Skewness	0.118	-1.407	-0.097	0.785	1.581	1.521
Kurtosis	-1.766	1.246	-1.169	-0.010	2.461	2.409

OLS Regression	Farm Yield - Non. (2003 - 2012)	Farm Yield - Irr. (2003 - 2012)	County Yield - Non. (2003 - 2012)	County Yield - Irr. (2003 - 2012)	F @ Planting (2003 - 2012)	F @ Harvest (2003 - 2012)
Intercept	33997.874	-59875.470	-41165.000	-21212.267	-9661.906	-9575.067
Slope	-16.753	30.080	20.673	11.061	4.849	4.804
R-Square	0.060	0.260	0.055	0.049	0.437	0.279
F-Ratio	0.507	2.804	0.461	0.411	6.198	3.100
Prob(F)	0.497	0.133	0.516	0.539	0.038	0.116
S.E.	23.523	17.964	30.440	17.250	1.948	2.728
T-Test	-0.712	1.674	0.679	0.641	2.490	1.761
Prob(T)	0.494	0.128	0.514	0.537	0.034	0.112

Table 5. Mississippi County, Arkansas Summary Statistics & OLS Regression

Summary Statistics	Farm Yield - Non (2003 - 2012)	Farm Yield - Irr. (2003 - 2012)	Co. Yield - Irr. Spline 1 (1981 - 1989)	Co. Yield - Irr. Spline 2 (1999 - 2012)	Co. Yield - Non. Spline 1 (1981 - 2003)	Co. Yield - Non. Spline 2 (2004 - 2012)	F @ Planting (2003 - 2012)	F @ Harvest (2003 - 2012)
Mean	813.390	1041.130	806.080	947.903	606.023	727.893	70.895	69.136
StDev	283.478	213.388	147.506	137.768	161.152	157.564	19.966	22.179
95 % LCI	577.290	863.405	721.073	855.500	513.152	622.212	54.266	50.664
95 % UCI	1049.490	1218.855	891.087	1040.305	698.893	833.573	87.524	87.607
Min	416.600	711.800	588.000	728.571	272.211	451.282	50.330	46.573
Median	779.050	1030.450	789.525	961.325	605.299	723.797	64.167	64.819
Max	1320.500	1319.300	1056.000	1155.429	925.714	983.645	114.576	112.329
Skewness	0.384	-0.139	0.261	-0.218	-0.069	-0.284	1.373	1.073
Kurtosis	-0.517	-1.409	-1.118	-1.249	-0.015	-0.125	1.486	0.259

OLS Regression	Farm Yield - Non (2003 - 2012)	Farm Yield - Irr. (2003 - 2012)	Co. Yield - Irr. Spline 1 (1981 - 1989)	Co. Yield - Irr. Spline 2 (1999 - 2012)	Co. Yield - Non. Spline 1 (1981 - 2003)	Co. Yield - Non. Spline 2 (2004 - 2012)	F @ Planting (2003 - 2012)	F @ Harvest (2003 - 2012)
Intercept	-151582.627	-128766.253	-20206.654	-34483.236	-22584.287	-20950.885	-9131.710	-8367.415
Slope	75.913	64.661	10.562	17.667	11.656	10.810	4.584	4.203
R-Square	0.657	0.842	0.146	0.288	0.149	0.082	0.483	0.329
F-Ratio	15.349	42.538	2.738	4.849	2.804	1.077	7.481	3.925
Prob(F)	0.004	0.000	0.117	0.048	0.113	0.320	0.026	0.083
S.E.	19.377	9.914	6.383	8.023	6.961	10.416	1.676	2.121
T-Test	3.918	6.522	1.655	2.202	1.674	1.038	2.735	1.981
Prob(T)	0.004	0.000	0.116	0.046	0.112	0.318	0.023	0.079

A multivariate empirical (MVEMP) distribution was used to calculate the parameters for simulating yields and prices. Farm level yields for the Texas farms used percent deviations from the mean because there was no trend in the data. County yields were percent deviations from trend based on the spline trend regressions. Mississippi County's parameters were calculated using percent deviations from trend because of the existing trend in all four variables. Using the correlation matrix calculated using the residuals from mean or trend generated for the MVEMP distribution and a vector of independent uniform deviates, an array of correlated uniform standard deviates (CUSDs) was simulated by Simetar© for 2015. The sampling process was repeated for 500 iterations.

Stochastic values for each variable were simulated using the respective mean, CUSD, S(i), and F(x).

*Stochastic value = mean * (1+EMP(S(i), F(x),CUSD))*

Where *S(i)* values are the sorted deviations from the mean (or trend) as a percent of mean (or trend) (the *S(i)* values for Mississippi County, AR are sorted deviations from trend as a percent of the predicted, these values are sorted random values). The *F(x)* values are the cumulative probabilities for the *S(i)* value. *Correlated Uniform Standard Deviates (CUSD)* are used to simulate multivariate empirical distributions in the EMP function.

To validate the simulated random numbers statistical hypothesis tests in Simetar© were utilized. Hypothesis testing was conducted using the: Hotelling's T-Squared test to determine if the simulated means are statistically equal to the means of the original data, and Box's M test of homogeneity for covariance was used to test if the simulated covariance equals the initial multivariate distribution (Richardson, 2010).

The stochastic values, simulated from the historical yield and price data, were used to build the intermediate and final equations to calculate the KOV – program net indemnity. The KOV was simulated for 58 different scenarios for each representative farm for 2015. The number of cotton acres in production has been kept at a constant one acre for each farm, so the KOV can be compared across farms.

Formulas for STAX and SCO

Many of the equations and variables are stochastic in nature because they are dependent on yield or price. Refer to Tables 6 – 9 below for a complete description of model equations and variables.

STAX Equations

Expected County Revenue = expected county yield * projected price

Final Expected County Revenue = expected county yield * maximum (projected or harvest price)

Actual County Revenue = actual county NASS yield * harvest price

STAX County Trigger = expected county revenue * loss threshold

STAX Trigger Met = actual county revenue < STAX county trigger

STAX Range of Coverage = loss threshold - underlying coverage

Policy Protection = range of coverage * final expected county revenue * STAX factor

Revenue Ratio = actual county revenue (NASS) / final expected county revenue

Loss = IF (revenue ratio<loss threshold, loss threshold-revenue ratio, 0)

Payment Factor = maximum (0, ((loss threshold - revenue ratio) / coverage level))

Indemnity = policy protection * payment factor

Actual Indemnity = IF (indemnity<policy protection, indemnity, IF (indemnity>policy protection, policy protection))

SCO Equations

Final Expected County Revenue = expected county yield * maximum (projected or harvest price)

Actual County Revenue = actual county NASS yield * harvest price

Expected Farm Revenue = farm APH yield * projected price

Final Expected Farm Revenue = farm APH yield * maximum (projected or harvest)

SCO County Trigger = expected county revenue * .86

SCO Trigger Met = actual county revenue < SCO trigger

SCO Range = loss trigger - underlying coverage

Expected Crop Value = final expected farm revenue

Expected Crop Value Insured = final expected farm revenue * insurance election

SCO Protection = expected crop value * SCO range

Revenue Ratio = actual county revenue / final expected county revenue

Loss = IF (revenue ratio < loss threshold, loss threshold – revenue ratio, 0)

Payment Factor = (loss threshold - rev ratio) / SCO range

Indemnity = payment factor * SCO protection

Actual Indemnity = IF (indemnity<policy protection, indemnity, IF (indemnity>policy protection, policy protection))

Table 6. STAX Equations Defined

Variable	Definition	Equation	Stochasic or Simulated	Policy Value	Producer Election
Expected County Revenue	Expected county yield multiplied by the project price.	expected county yield * projected price	X		
Final Expected County Revenue	The revenue is determined by multiplying the final area yield by the maximum of projected or harvest price. The final area revenue is used to determine whether and indemnity will be due.	expected county yield *maximum(projected or harvest price)	X		
Actual County Revenue	Determined by multiplying actual county NASS yield by the harvest price. Used to determine the county revenue.	actual county NASS yield * harvest price	X		
STAX County Trigger	multiplied by the loss threshold elected by the producer to determine what the required county loss is to receive an	expected county revenue * loss threshold	X		
STAX Trigger Met	The actual county revenue is less than the STAX county trigger than an indemnty is paid based on the chosen percentage trigger.	actual county revenue < STAX county trigger	X		
STAX Range of Coverage	The percentage of expected area revenue you choose, ranging from 90 percent to 75 percent, below which an indemnity is paid and which is contained in the actuarial documents.	loss threshold - underlying coverage		X	X
Policy Protection	The maximum dollar amount of insurance provided by this policy for each type and practice.	range of coverage * final expected county revenue * STAX factor	X		X
Revenue Ratio	Actual county revenue divided by final expected county revenue to determine the anticipated county loss.	actual county revenue / final expected county revenue	X		
Loss	The loss a producer incurs within the elected coverage range.	"=IF(revenue ratio<loss threshold, loss threshold-revenue ratio,0)	X		
Payment Factor	Factor that represetns the prodction area wide loss as compared to your coverage range.	Max(0, ((loss threshold - revenue ratio) / coverage level))	X		
Indemnity	Policy protection multiplied by the payment factor to determine what percentage of the policy protection the producer will receive.	policy protection * payment factor	X		
Actual Indemnity	In some years producers will not recieve an indemnity because of high revenue, in those years an indemnity can be calculated but not returned. This equation allows for a zero indemnity to be returned in such production years.	"=IF(indemnity<policy protection,indemnity,IF(indemnity>policy protection,policy protection))	X		

Table 7. STAX Variables Defined

Variable	Definition	Stochasic or Simulated	Policy Value	Producer Election
Expected County Yield	Higher of expected county trend NASS yield or 5-year moving average county NASS yield. The county data will be found in the actuarial documents.	X		
Actual County NASS Yield	Historical yield data found in the the National Agricultural Statistics Service.	X		
Projected Price	Futures price at planting.	X		
Harvest Price	Futures price at harvest.	X		
Loss Threshold	The elected percent loss of the expected county revenue to be used to trigger an indemnity. Ranges from 90 percent down to 75 percent in increments of 5.		X	X
Underlying Coverage	Insurance policy purchased in addition to the companion policy by the producer to insure their crop. The policy can be purchased for yield or revenue protection, and reveune protection - harvest price exclusion.			X
STAX Factor	Multiplication factor in determing the amount of the companion policy purchased. Ranges from 80 - 120 percent.		X	X

Table 8. SCO Equations Defined

Variable	Definition	Equation	Stochasic or Simulated	Policy Value	Producer Election
Expected Farm Revenue	Expected county yield multiplied by the projected price.	expected county yield * projected price	X		
Final Expected County Revenue	The revenue determined by multiplying the final area yeild by the projected or harvest price. The final area revenue is used to determine whether and indemnity will be due.	expected county yield *maximum(projected or harvest price)	X		
Actual County Revenue	Determined by multiplying actual county NASS yield by the harvest price. Used to determine the county revenue.	actual county NASS yield * harvest price	X		
Expected Farm Revenue	Approved historical farm yield multiplied by the project price. The historical approved yield will be found in actuarial documents.	farm APH yield * projected price	X		
Final Expected Farm Revenue	Approved historical farm yield multiplied by the maximum of the projected or harvest price. The historical approved yield will be found in actuarial documents.	fram APH yield * maximum (projected or harvest)	X		
SCO County Trigger	Expected county revenue multiplied by the loss threshold of 86 percent to determine what the required county loss is to receive an indemnity.	expected county revenue * loss threshold	X		
SCO Trigger Met	The actual county revenue is less than the SCO county trigger then an indemnty is paid to the producer.	actual county revenue < SCO trigger	X		
SCO Range	The percent of expected crop value that can be covered by SCO. It is the difference between the area loss threshold and the coverage level of the underlying policy.	loss threshold - underlying coverage		X	X
Expected Crop Value	The value of the crop based on approved yields and the projected price. For revenue protection policies (the case here), expected crop value may increase if the harvest price is higher than the projected price.	final expected farm revenue	X		
Expected Crop Value Insured	The amount of crop insured by the producer's underlying coverage.	final expected farm revenue * insurance election fraction	X		X
SCO Protection	The dollar amount of insurance provided by SCO based on coverage level, type, and practice. The amount of remaining liability from the underlying coverage that is covered by SCO	expected crop value * SCO range	X		X
Revenue Ratio	Actual county revenue divided by final expected county revenue to determine the anticipated county loss.	actual county revenue / final expected county revenue	X		
Loss	The loss a producer incurs within the elected coverage range.	"=IF(revenue ratio<loss threshold, loss threshold-revenue ratio,0)	X		
Payment Factor	Factor that represetns the prodction area wide loss as compared to the supplemental coverage range. Used to determine the amount of indemnity to be paid uner SCO.	(loss threshold - revenue ratio) / SCO range	X		
Indemnity	Policy protection multiplied by the payment factor to determine what percentage of the policy protection the producer will receive.	payment factor * SCO protection	X		
Actual Indemnity	In some years producers will not recieve an indemnity because of high revenue, in those years an indemnity can be calculated but not returned. This equation allows for a zero indemnity to be returned in such production years.	"=IF(indemnity<policy protection,indemnity,IF(indemnity>policy protection,policy protection))	X		

Table 9. SCO Variables Defined

Variable	Definition	Stochasic or Simulated	Policy Value	Producer Election
Expected County Yield	Higher of expected county trend NASS yield or 5-year moving average county NASS yield. The county data will be found in the actuarial documents.	X		
Actual County NASS Yield	Historical yield data found in the the National Agricultural Statistics Service.	X		
Farm APH Yield	Approved historical yields of producer's farm.	X		
Projected Price	Futures price at planting.	X		
Harvest Price	Futures price at harvest.	X		
Loss Threshold	The percent loss the county must incur on the expected revenue. For SCO, the county must experience ashallow loss of 86 percent before program takes affect in a given crop year.		X	X
Underlying Coverage	Insurance policy purchased in addition to the companion policy by the producer to insure their crop.			X

The above equations for STAX and SCO were used to simulate the respective indemnity for each program.

Program Net Indemnity

The key output variable for this study is the respective program net indemnity, and was calculated by the following equation.

Program Net Indemnity = (STAX/SCO indemnity – STAX/SCO premium)

To determine the net indemnity per acre, the underlying coverage premium and indemnity would need to be added to the program equation.

Scenarios

Scenarios are alternative strategies or policy actions, used to examine assumptions for the exogenous or control variables (Richardson, 2010). Fifty-eight scenarios were developed based on the STAX and SCO parameters to analyze the optimal rate of additional coverage for a producer. Each county has a total of 116 scenarios; 58 scenarios for each production practice, except for Hill County (dryland cotton only).

Monte Carlo simulation is utilized to determine each scenarios' individual probability distribution for the KOV. The greater the probability of a positive program net indemnity, the more cost effective that scenario is for managing risk in relation to its premium. Producers have 50 possible STAX scenarios to choose from based on the three input categories. STAX scenarios are depicted in Table 10.

1. Loss Threshold. At what county percentage loss does the producer want STAX to activate?
2. STAX Factor. The percentage of protection chosen (.08 – 1.20) by the decision-maker.

3. Companion Coverage. The level of individual coverage the producer elects for his crop. STAX is in addition to this coverage.

If a producer does not enroll in STAX and elects to instead enroll into SCO the scenarios are considerably fewer. SCO has eight possible scenarios, shown in detail in Table. 11. The scenarios in SCO are determined by two factors; subtracting the loss threshold from the companion coverage:

1. Loss Threshold. The fourteen percent loss that a county must incur before the program takes effect. Eighty-six percent (86 percent) is the loss threshold for the area-wide program.
2. Companion Coverage. The level of individual coverage the producer elects for cotton.

Table 10. STAX Scenarios

STAX Scenarios	STAX Loss Threshold	STAX Factor	Producer Elected Companion Coverage
1	75%	0.80	70%
2	75%	0.90	70%
3	75%	1.00	70%
4	75%	1.10	70%
5	75%	1.20	70%
6	80%	0.80	70%
7	80%	0.90	70%
8	80%	1.00	70%
9	80%	1.10	70%
10	80%	1.20	70%
11	80%	0.80	75%
12	80%	0.90	75%
13	80%	1.00	75%
14	80%	1.10	75%
15	80%	1.20	75%
16	85%	0.80	70%
17	85%	0.90	70%
18	85%	1.00	70%
19	85%	1.10	70%
20	85%	1.20	70%
21	85%	0.80	75%
22	85%	0.90	75%
23	85%	1.00	75%
24	85%	1.10	75%
25	85%	1.20	75%
26	85%	0.80	80%
27	85%	0.90	80%
28	85%	1.00	80%
29	85%	1.10	80%
30	85%	1.20	80%
31	90%	0.80	70%
32	90%	0.90	70%
33	90%	1.00	70%
34	90%	1.10	70%
35	90%	1.20	70%
36	90%	0.80	75%
37	90%	0.90	75%
38	90%	1.00	75%
39	90%	1.10	75%
40	90%	1.20	75%
41	90%	0.80	80%
42	90%	0.90	80%
43	90%	1.00	80%
44	90%	1.10	80%
45	90%	1.20	80%
46	90%	0.80	85%
47	90%	0.90	85%
48	90%	1.00	85%
49	90%	1.10	85%
50	90%	1.20	85%

Table 11. SCO Scenarios

SCO Scenarios	SCO Loss Threshold	Producer Elected Companion Coverage
51	86%	50%
52	86%	55%
53	86%	60%
54	86%	65%
55	86%	70%
56	86%	75%
57	86%	80%
58	86%	85%

Risk Ranking

After simulating risky alternatives the next step is to rank or order them in terms of the “best” strategy. This can be difficult because no two decision-makers have the same risk preferences or experiences. As economists, it is our job to educate and inform, not decide or choose on behalf of the decision-maker.

Risk ranking can be achieved using various methods from simple to complex, and those methods can have varying results based on their focus point of ranking risk. Some of the more simple methods include: mean only, standard deviation, mean variance, and best/worst case scenarios. Even though these methods are easily calculated and ranked, they can often be misleading in terms of ranking risk because they abandon various aspects of monitoring risk and rely on summary statistics. More advanced methods of ranking risky alternatives are available, and rank the alternatives by incorporating all simulated outcomes.

The two methods used for this project were stochastic dominance with respect to a function (SDRF) and stochastic efficiency with respect to a function (SERF).

Stochastic dominance with respect to a function was first introduced by Meyer (1977) as generalized stochastic dominance. The SDRF method requires that one know the decision-maker's risk aversion coefficient, which is a significant limitation in policy analysis where the results are to be applied to many decision-makers. A second limitation of SDRF is that it does not simultaneously rank alternatives. Hardaker, Richardson, Lien, and Schumann's (2004) SERF procedure was used to overcome the limitations of SDRF. SERF evaluates certainty equivalences for many risk aversion coefficients (RACs), allowing SERF to rank risky alternatives simultaneously for a wide range of risk averse decision-makers.

SDRF and SERF were used to determine the risk ranking preference for each scenario. SDRF was determined assuming a negative exponential utility function and using lower and upper RACs. For SDRF the relative risk aversion was selected to represent a rather risk averse decision-maker, and for SERF the upper RAC was for an extremely risk averse decision-maker. SDRF was used to narrow the 58 scenarios to the top ten scenarios to be ranked using SERF.

The upper RAC for SDRF was calculated dividing 2.0 by wealth to calculate a relative risk aversion coefficient for a rather risk averse decision-maker. A similar calculation was used for the upper RAC of SERF, only 4.0 was divided by wealth to calculate a relative risk aversion coefficient for an extremely risk averse decision-maker. Wealth was determined on a per acre basis for each county, type of production land was kept in consideration because irrigated and non-irrigated cropland values vary considerably. Probably more important than cropland type, is the geographic location of the land. In this case, the study considered wealth to be 75 percent of the average price on cropland for the county, with the consideration of irrigated or non-irrigated cropland. See tables 12 and 13 for a complete list of upper RACs for each county by cropland type.

Table 12. Lower and Upper Risk Aversion Coefficients for Stochastic Dominance with Respect to a Function for a Rather Risk Averse Decision-Maker

County - Production Practice	Lower RAC	Upper RAC
Crosby - Irrigated	0	0.0019
Crosby - Non-Irrigated	0	0.0041
Dawson - Irrigated	0	0.0019
Dawson - Non-Irrigated	0	0.0032
Hill - Non-Irrigated	0	0.00097
Moore - Irrigated	0	0.0012
Moore - Non-Irrigated	0	0.0046
Mississippi, AR - Irrigated	0	0.00098
Mississippi, AR - Non-Irrigated	0	0.0011

Table 13. Lower and Upper Risk Aversion Coefficients for Stochastic Efficiency with Respect to a Function for a Very Risk Averse Decision-Maker

County - Production Practice	Lower RAC	Upper RAC
Crosby - Irrigated	0	0.0038
Crosby - Non-Irrigated	0	0.0082
Dawson - Irrigated	0	0.0038
Dawson - Non-Irrigated	0	0.0064
Hill - Non-Irrigated	0	0.0019
Moore - Irrigated	0	0.0025
Moore - Non-Irrigated	0	0.0092
Mississippi, AR - Irrigated	0	0.001
Mississippi, AR - Non-Irrigated	0	0.0023

CHAPTER IV

RESULTS AND ANALYSIS

This analysis was conducted using five representative farms maintained by the AFPC. Each representative farm was simulated for 58 scenarios (Tables 10 and 11) that the decision-maker can elect from based on STAX and SCO options as stated in the 2014 Farm Bill. Chapter IV compares the results, including the summary statistics, as well as, SDRF and SERF rankings to explain the risk ranking preferences. The results for each representative farm are presented in terms of program net indemnity received per acre. By limiting the analysis to one acre, and not using each farm's total acreage, this allows for easy comparison between farms. Program net indemnity is the difference between the payout of the selected program (indemnity) and the cost of the program (premium). Results for each county are reported by production practice (irrigated and non-irrigated), then followed by a summary for the county.

Crosby County

Irrigated

STAX and SCO have non-zero probabilities that the program net indemnity will be negative for all scenarios for irrigated cotton in Crosby County (Table 14). The probability of receiving an indemnity greater than the premium (positive program net indemnity) is 53.7 percent or greater for all scenarios (Table 14). Scenarios 46 – 50 returned the smallest probability of a negative program net indemnity at 11.7 percent with indemnity mean values ranging from a high of $32.32/acre down to $21.50/acre

(Table 14). Scenarios 46 – 50 returned identical probabilities because they are considered a "scenario bundle", meaning their coverage level is the same except for the varying STAX factor (refer to Table 10). While Scenarios 46 – 50 returned the largest probabilities of receiving a positive program net indemnity (88.3 percent), they did not return the highest mean values. The highest mean value for program net indemnity is represented by Scenario 35 at $104.41/acre (Table 14). Scenario bundle 31 – 35 delivered the highest mean values on average for all STAX bundles and SCO scenarios – ranging from $69.61/acre to $104.41/acre. Remembering that Scenarios 31 – 35 have a 90 percent STAX threshold with a 70 percent individual coverage and it is the STAX factor of 0.80 – 1.20. The varying STAX factor is the cause of the "cascading affect" that is seen in the increasing mean values; as the STAX factor increases so does the mean value of the possible program net indemnity. Scenario bundle 46 – 50 (90 percent STAX threshold and 85 percent individual coverage) has the highest probability of receiving a positive program net indemnity, but it is bundle 31 – 35 that returns the largest means values for program net indemnity per acre (Table 14). It is worth noting that the difference in probability of program net indemnity being less than zero (negative) for the two bundles mentioned above is only eight tenths of a point. Scenario bundle 1 – 5 were the worst strategies for STAX scenarios. Scenarios 1 – 5 have the smallest means (less than $20/acre) and highest probabilities of receiving a negative program net indemnity – 46.3 percent probability that the program net indemnity will be less than zero (Table 14). While Scenarios 1 – 5, as a bundle, returned the lowest probabilities of not receiving a positive program net indemnity, they only cover a five percentage point range (STAX loss threshold of 75 percent and a companion coverage of 70 percent). It is unlikely that producers would elect this bundle of scenarios (Scenarios 1 – 5) because of the liability that is left uninsured.

SCO scenarios returned mean program net indemnity values ranging from a high of $75.06/acre to a low of $4.62/acre (Scenarios 51 – 58, Table 14). SCO Scenarios 51 and 52 had the largest mean values for program net indemnity (about $75/acre) with probabilities of program net indemnity being negative 24.7 percent and 23.2 percent of the time, respectively (Table 14). But, it must be remembered that SCO requires a 14 percent county loss threshold to trigger an indemnity. Such a loss may not be acceptable to risk averse decision-makers.

Based on the SDRF analysis, a rather risk averse decision-maker would prefer Scenario 35 (Table 15). Scenario 35 indemnifies the greatest range of liability. Based on SDRF, a rather risk averse decision-maker would least prefer Scenario 58, and this is supported by the summary statistics showing its very low mean value for program net indemnity (Table 15). Scenario 58 only indemnifies one percentage point of liability, therefore, it is unlikely that a decision-maker would choose this scenario because of its inability to cover revenue loss and the high cost of the underlying coverage.

Figure 1 depicts the SERF results for the top ten SDRF scenarios. The SERF analysis indicates that Scenario 35 is most preferred followed by 34 for decision-makers regardless of risk aversion level because the certainty equivalent lines never cross. Scenarios 31 – 35 are the same in terms of threshold loss (90 percent) and individual coverage (70 percent), it is the STAX factor that varies between Scenarios 31 – 35, with

Scenario 35 having the highest STAX Factor of 1.2. While Scenarios 35 and 34 are clearly most preferred across all risk aversion preferences, there are differences in the remaining scenarios. For a decision-maker with an ARAC of .0015 or less, SCO Scenarios 51 – 53 are more preferred to the STAX Scenario 38. Even though scenario bundle 46 – 50 had the highest probability of receiving a positive program net indemnity (Table 14), it is not represented in the SERF analysis and not preferred because it has relatively low mean values, indemnifying only 5 percentage points of liability.

Non-Irrigated

The mean values represented in the summary statistics for program net indemnities of non-irrigated cotton in Crosby County were significantly less than those for irrigated cotton with several mean values or non-irrigated cotton even being negative (Table 16). The largest mean value is $7.65/acre under Scenario 40 and the smallest mean value is a negative $14.62/acre represented by Scenario 51 (Table 16). Non-irrigated cotton mean values for program net indemnities can be negative for several reasons:

1) the relative costs (premiums) are high,
2) non-irrigated production is riskier than irrigated making it more expensive to insure, and
3) payouts (indemnities) are low.

Do not mistake that the negative mean values indicate the decision-maker is paying additional monies, but rather the premium paid by the decision-maker exceeds the indemnity received. Additionally, there could be years in which a decision-maker may not receive an indemnity at all. Remember this is how insurance markets work, paying into protection that one hopes not to have to use.

Scenarios 46 – 50 had the highest probabilities of returning a positive program net indemnity, 39.8 percent, but they did not have the largest mean values (Table 16). The largest mean values were represented by scenario bundle 36 – 40, ranging from \$5.09/acre up to \$7.65/acre (Table 16). Scenario bundle has a 90 percent STAX threshold with a 75 percent individual coverage (Table 10), effectively indemnifying an extra fifteen percent of the remaining liability at a subsidized rate. The worst probability for a positive program net indemnity occurs for SCO, with Scenario 51 having a 98.3 percent probability of program net indemnity being negative (Table 16). SCO scenarios returned the highest probabilities for program net indemnity being less than zero (negative), and all mean values for SCO alternatives were negative (Table 16). The low probabilities of a positive program net indemnity and negative mean values are the result of high premium cost to purchase SCO and the threshold loss a county must incur before the program pays-off.

SDRF and SERF risk ranking methods were used to examine a decision-maker's risk ranking preferences for non-irrigated cotton production. SDRF ranked all 58 scenarios from most to least preferred with Scenario 40 being most preferred and Scenario 51 least preferred (Table 17). SERF was used to rank the top ten scenarios for extremely risk averse decision makers. As depicted in Figure 2, Scenario 40 is ranked first in preference for all decision-makers who are risk averse because the CE lines never cross. Scenarios 37 and 38 also remain constant in the risk ranking preferences for a decision-maker because the CE lines never cross (Figure 2). For the other seven scenarios, the preference for any given scenario varies based on the decision-maker's ARAC, and this is evident by the multiple crossing of CE lines. With an ARAC of .004 or a moderately risk averse decision-maker, preference for a given scenario begins to change for several scenarios (Figure 2).

Summary for Crosby County

As expected irrigated cotton production for Crosby County received higher program net indemnities than non-irrigated due to irrigated cotton being a higher valued crop receiving higher program returns. Non-irrigated cotton had much higher probabilities of not receiving a positive program net indemnity due to the relatively higher cost of the insurance. Scenario bundle 31 – 35 is preferred for both types of production because they cover the most liability for their respective premiums. Scenarios 31 – 35 allow decision-makers the greatest range of coverage with the greatest range of companion coverage (90 percent down to 70 percent) thus creating an efficient risk management strategy. While scenario bundle 31 – 35 are consistent, they are not always most preferred given a decision-maker's risk preference. This is evident in non-irrigated cotton, as Scenario 40 was most preferred. SCO (Scenarios 51 – 53) also returned viable risk management alternatives for irrigated cotton. The variation of preferred scenarios does indicate that STAX and SCO have several scenarios for optimal risk management, and those management strategies for a decision-maker can vary based on production practice, price, and location.

Table 14. Summary Statistics of Program Net Indemnities for Alternative Levels of STAX and SCO Coverage on a Crosby County Irrigated Cotton Farm

Variable	Mean	StDev	CV	Min	Max	P(x<0)
STX1_0.75_0.7	12.94	14.36	111.02	-1.39	34.99	0.463
STX2_0.75_0.7	14.56	16.16	110.99	-1.56	39.37	0.463
STX3_0.75_0.7	16.18	17.95	110.97	-1.73	43.75	0.463
STX4_0.75_0.7	17.79	19.75	111.01	-1.91	48.11	0.463
STX5_0.75_0.7	19.41	21.54	110.99	-2.08	52.49	0.463
STX6_0.8_0.7	29.01	27.11	93.44	-3.05	69.71	0.328
STX7_0.8_0.7	32.64	30.50	93.44	-3.43	78.43	0.328
STX8_0.8_0.7	36.27	33.89	93.43	-3.81	87.14	0.328
STX9_0.8_0.7	39.90	37.28	93.43	-4.19	95.86	0.328
STX10_0.8_0.7	43.52	40.66	93.43	-4.57	104.57	0.328
STX11_0.8_0.75	16.08	13.57	84.43	-1.66	34.72	0.318
STX12_0.8_0.75	18.08	15.27	84.45	-1.87	39.06	0.318
STX13_0.8_0.75	20.09	16.97	84.45	-2.08	43.40	0.318
STX14_0.8_0.75	22.10	18.66	84.46	-2.29	47.73	0.318
STX15_0.8_0.75	24.11	20.36	84.43	-2.49	52.08	0.318
STX16_0.85_0.7	48.11	37.56	78.06	-5.05	104.09	0.214
STX17_0.85_0.7	54.13	42.25	78.06	-5.68	117.10	0.214
STX18_0.85_0.7	60.14	46.95	78.06	-6.31	130.12	0.214
STX19_0.85_0.7	66.16	51.64	78.06	-6.94	143.13	0.214
STX20_0.85_0.7	72.17	56.34	78.06	-7.57	156.14	0.214
STX21_0.85_0.75	35.18	24.74	70.33	-3.66	69.10	0.210
STX22_0.85_0.75	39.57	27.83	70.33	-4.12	77.74	0.210
STX23_0.85_0.75	43.97	30.92	70.34	-4.58	86.37	0.210
STX24_0.85_0.75	48.37	34.02	70.32	-5.03	95.02	0.210
STX25_0.85_0.75	52.76	37.11	70.33	-5.49	103.65	0.210
STX26_0.85_0.8	19.10	12.01	62.91	-2.00	34.38	0.200
STX27_0.85_0.8	21.49	13.52	62.91	-2.25	38.68	0.200
STX28_0.85_0.8	23.87	15.02	62.91	-2.50	42.98	0.200
STX29_0.85_0.8	26.26	16.52	62.91	-2.75	47.27	0.200
STX30_0.85_0.8	28.65	18.02	62.91	-3.00	51.57	0.200
STX31_0.9_0.7	69.61	45.38	65.19	-7.35	138.17	0.125
STX32_0.9_0.7	78.31	51.05	65.19	-8.27	155.44	0.125
STX33_0.9_0.7	87.01	56.72	65.19	-9.19	172.71	0.125
STX34_0.9_0.7	95.71	62.39	65.19	-10.11	189.98	0.125
STX35_0.9_0.7	104.41	68.06	65.19	-11.03	207.25	0.125
STX36_0.9_0.75	56.66	33.02	58.27	-5.97	103.17	0.124
STX37_0.9_0.75	63.75	37.14	58.26	-6.71	116.07	0.124
STX38_0.9_0.75	70.83	41.27	58.27	-7.46	128.97	0.124
STX39_0.9_0.75	77.92	45.40	58.26	-8.20	141.87	0.124
STX40_0.9_0.75	85.00	49.52	58.26	-8.95	154.76	0.124
STX41_0.9_0.8	40.60	20.85	51.37	-4.30	68.46	0.121
STX42_0.9_0.8	45.67	23.46	51.37	-4.84	77.02	0.121
STX43_0.9_0.8	50.74	26.07	51.37	-5.38	85.57	0.121
STX44_0.9_0.8	55.81	28.67	51.37	-5.92	94.13	0.121
STX45_0.9_0.8	60.89	31.28	51.37	-6.45	102.69	0.121
STX46_0.9_0.85	21.50	9.65	44.91	-2.30	34.08	0.117
STX47_0.9_0.85	24.18	10.86	44.92	-2.59	38.34	0.117
STX48_0.9_0.85	26.87	12.07	44.92	-2.88	42.60	0.117
STX49_0.9_0.85	29.55	13.28	44.93	-3.17	46.85	0.117
STX50_0.9_0.85	32.23	14.48	44.93	-3.46	51.11	0.117
SCO51_0.86_0.5	75.06	78.26	104.26	-18.80	275.00	0.247
SCO52_0.86_0.55	75.97	76.78	101.08	-17.17	243.54	0.232
SCO53_0.86_0.6	74.58	71.41	95.75	-15.26	211.80	0.228
SCO54_0.86_0.65	68.58	60.90	88.81	-13.44	171.34	0.223
SCO55_0.86_0.7	58.63	47.57	81.13	-11.18	129.60	0.211
SCO56_0.86_0.75	44.13	32.20	72.97	-8.36	88.43	0.201
SCO57_0.86_0.8	26.07	16.96	65.08	-4.97	47.82	0.189
SCO58_0.86_0.85	4.62	2.64	57.05	-0.90	7.90	0.166

Table 15. Stochastic Dominance with Respect to a Function for Rankings of Program Net Indemnities for Alternative Levels of STAX and SCO Coverage on a Crosby County Irrigated Cotton Farm

	Efficient Set Based on SDRF at	
	Upper RAC	**0.0019**
	Name	Level of Preference
1	STX35_0.9_0.	Most Preferred
2	STX34_0.9_0.	2nd Most Preferred
3	STX33_0.9_0.	3rd Most Preferred
4	STX40_0.9_0.	4th Most Preferred
5	STX39_0.9_0.	5th Most Preferred
6	STX32_0.9_0.	6th Most Preferred
7	SCO52_0.86_	7th Most Preferred
8	SCO53_0.86_	8th Most Preferred
9	SCO51_0.86_	9th Most Preferred
10	STX38_0.9_0.	10th Most Preferred
11	STX20_0.85_(	11th Most Preferred
12	STX31_0.9_0.	12th Most Preferred
13	SCO54_0.86_	13th Most Preferred
14	STX19_0.85_(	14th Most Preferred
15	STX37_0.9_0.	15th Most Preferred
16	STX45_0.9_0.	16th Most Preferred
17	STX18_0.85_(	17th Most Preferred
18	SCO55_0.86_	18th Most Preferred
19	STX36_0.9_0.	19th Most Preferred
20	STX44_0.9_0.	20th Most Preferred
21	STX17_0.85_(	21st Most Preferred
22	STX25_0.85_(	22nd Most Preferred
23	STX43_0.9_0.	23rd Most Preferred
24	STX24_0.85_(	24th Most Preferred
25	STX16_0.85_(	25th Most Preferred
26	STX42_0.9_0.	26th Most Preferred
27	SCO56_0.86_	27th Most Preferred
28	STX23_0.85_(	28th Most Preferred
29	STX10_0.8_0.	29th Most Preferred
30	STX41_0.9_0.	30th Most Preferred
31	STX22_0.85_(	31st Most Preferred
32	STX9_0.8_0.7	32nd Most Preferred
33	STX8_0.8_0.7	33rd Most Preferred
34	STX21_0.85_(	34th Most Preferred
35	STX50_0.9_0.	35th Most Preferred
36	STX7_0.8_0.7	36th Most Preferred
37	STX49_0.9_0.	37th Most Preferred
38	STX30_0.85_(	38th Most Preferred
39	STX6_0.8_0.7	39th Most Preferred
40	STX48_0.9_0.	40th Most Preferred
41	STX29_0.85_(	41st Most Preferred
42	SCO57_0.86_	42nd Most Preferred
43	STX47_0.9_0.	43rd Most Preferred
44	STX15_0.8_0.	44th Most Preferred
45	STX28_0.85_(	45th Most Preferred
46	STX14_0.8_0.	46th Most Preferred
47	STX46_0.9_0.	47th Most Preferred
48	STX27_0.85_(	48th Most Preferred
49	STX13_0.8_0.	49th Most Preferred
50	STX5_0.75_0.	50th Most Preferred
51	STX26_0.85_(	51st Most Preferred
52	STX12_0.8_0.	52nd Most Preferred
53	STX4_0.75_0.	53rd Most Preferred
54	STX11_0.8_0.	54th Most Preferred
55	STX3_0.75_0.	55th Most Preferred
56	STX2_0.75_0.	56th Most Preferred
57	STX1_0.75_0.	57th Most Preferred
58	SCO58_0.86_	Least Preferred

Figure 1. Stochastic Efficiency with Respect to a Function for Rankings of Program Net Indemnities for Alternative Levels of STAX and SCO Coverage on a Crosby County Irrigated Cotton Farm

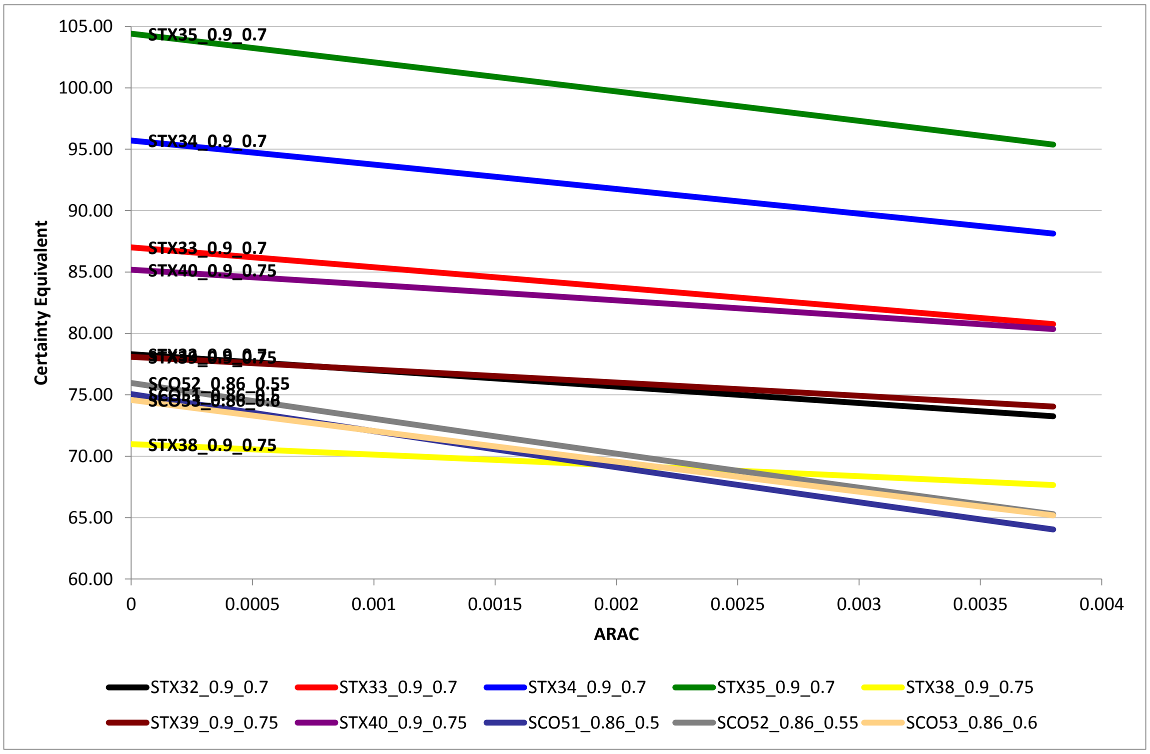


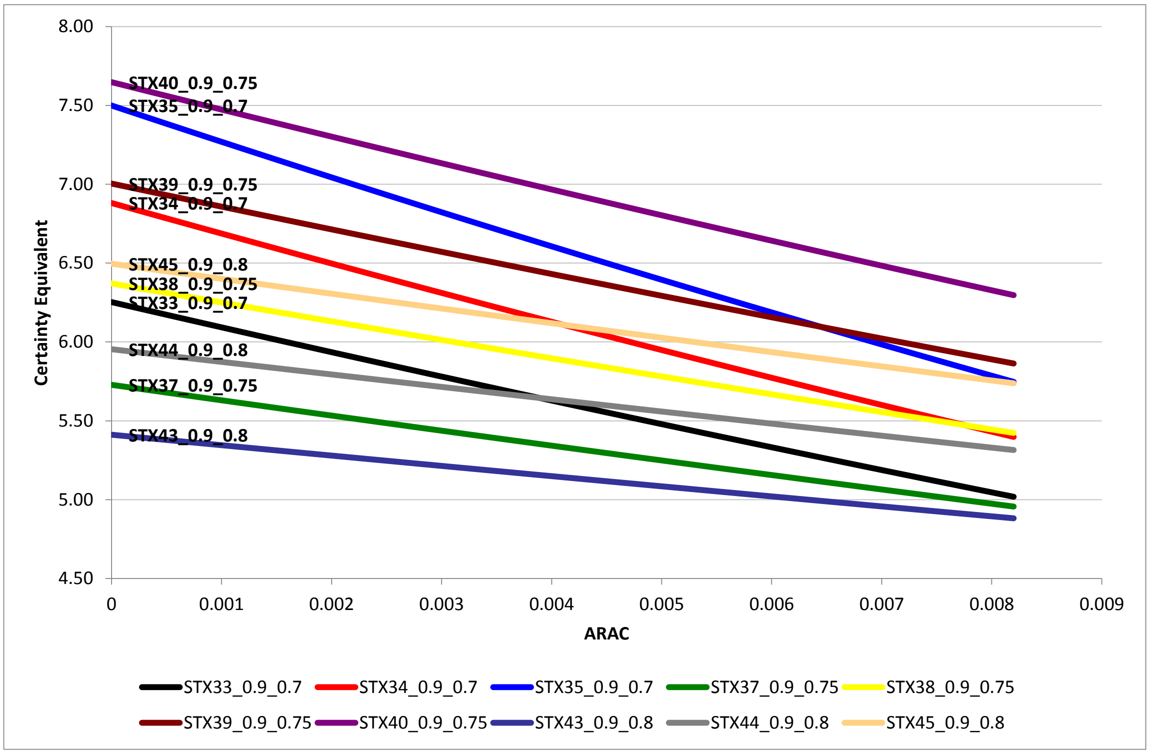
Table 16. Summary Statistics of Program Net Indemnities for Alternative Levels of STAX and SCO Coverage on a Crosby County Non-Irrigated Cotton Farm

Variable	Mean	StDev	CV	Min	Max	P(x<0)
STX1_0.75_0.7	-0.10	2.78	-2818.04	-0.94	12.00	0.904
STX2_0.75_0.7	-0.10	3.13	-3021.91	-1.05	13.51	0.904
STX3_0.75_0.7	-0.12	3.48	-2936.92	-1.17	15.00	0.904
STX4_0.75_0.7	-0.13	3.83	-2870.86	-1.29	16.50	0.904
STX5_0.75_0.7	-0.14	4.18	-3021.91	-1.40	18.01	0.904
STX6_0.8_0.7	0.67	6.19	925.98	-1.94	23.94	0.813
STX7_0.8_0.7	0.75	6.97	922.91	-2.18	26.93	0.813
STX8_0.8_0.7	0.83	7.74	931.55	-2.43	29.92	0.813
STX9_0.8_0.7	0.92	8.51	928.50	-2.67	32.91	0.813
STX10_0.8_0.7	1.00	9.29	925.98	-2.91	35.91	0.813
STX11_0.8_0.75	0.76	3.81	502.99	-1.01	11.93	0.802
STX12_0.8_0.75	0.86	4.29	499.32	-1.13	13.43	0.802
STX13_0.8_0.75	0.95	4.76	501.66	-1.26	14.91	0.802
STX14_0.8_0.75	1.05	5.24	498.80	-1.38	16.41	0.802
STX15_0.8_0.75	1.14	5.72	500.78	-1.51	17.90	0.802
STX16_0.85_0.7	2.33	10.19	437.79	-3.00	35.82	0.738
STX17_0.85_0.7	2.61	11.46	438.63	-3.38	40.29	0.738
STX18_0.85_0.7	2.91	12.73	437.79	-3.75	44.77	0.738
STX19_0.85_0.7	3.19	14.01	438.48	-4.13	49.25	0.738
STX20_0.85_0.7	3.49	15.28	437.79	-4.50	53.73	0.738
STX21_0.85_0.75	2.42	8.09	334.97	-2.07	23.81	0.729
STX22_0.85_0.75	2.73	9.10	333.89	-2.32	26.79	0.729
STX23_0.85_0.75	3.03	10.11	334.14	-2.58	29.77	0.729
STX24_0.85_0.75	3.33	11.13	334.34	-2.84	32.74	0.729
STX25_0.85_0.75	3.63	12.14	334.50	-3.10	35.72	0.729
STX26_0.85_0.8	1.66	4.58	276.45	-1.06	11.98	0.716
STX27_0.85_0.8	1.87	5.16	276.08	-1.19	13.48	0.716
STX28_0.85_0.8	2.07	5.73	277.12	-1.33	14.97	0.716
STX29_0.85_0.8	2.28	6.30	276.76	-1.46	16.47	0.716
STX30_0.85_0.8	2.49	6.88	276.45	-1.59	17.97	0.716
STX31_0.9_0.7	5.01	14.39	287.49	-4.10	47.66	0.635
STX32_0.9_0.7	5.62	16.19	287.87	-4.62	53.61	0.635
STX33_0.9_0.7	6.25	17.99	287.72	-5.13	59.57	0.635
STX34_0.9_0.7	6.88	19.79	287.59	-5.64	65.53	0.635
STX35_0.9_0.7	7.50	21.59	287.87	-6.16	71.48	0.635
STX36_0.9_0.75	5.09	12.50	245.26	-3.17	35.65	0.621
STX37_0.9_0.75	5.73	14.06	245.42	-3.57	40.10	0.622
STX38_0.9_0.75	6.37	15.62	245.16	-3.96	44.56	0.621
STX39_0.9_0.75	7.00	17.18	245.30	-4.36	49.02	0.622
STX40_0.9_0.75	7.65	18.74	245.10	-4.75	53.48	0.621
STX41_0.9_0.8	4.33	9.25	213.66	-2.17	23.90	0.614
STX42_0.9_0.8	4.87	10.40	213.61	-2.44	26.89	0.614
STX43_0.9_0.8	5.41	11.56	213.56	-2.71	29.88	0.614
STX44_0.9_0.8	5.95	12.71	213.53	-2.98	32.87	0.614
STX45_0.9_0.8	6.50	13.87	213.50	-3.25	35.86	0.614
STX46_0.9_0.85	2.65	4.97	187.61	-1.13	11.91	0.602
STX47_0.9_0.85	2.98	5.59	187.53	-1.27	13.40	0.602
STX48_0.9_0.85	3.31	6.21	187.47	-1.41	14.89	0.602
STX49_0.9_0.85	3.65	6.83	187.42	-1.55	16.38	0.602
STX50_0.9_0.85	3.97	7.45	187.85	-1.70	17.86	0.602
SCO51_0.86_0.5	-14.62	3.98	-27.23	-15.47	19.95	0.983
SCO52_0.86_0.55	-13.22	3.98	-30.11	-14.07	21.35	0.982
SCO53_0.86_0.6	-11.76	3.98	-33.85	-12.61	22.81	0.979
SCO54_0.86_0.65	-9.61	3.98	-41.42	-10.46	24.96	0.967
SCO55_0.86_0.7	-7.35	3.98	-54.15	-8.20	27.22	0.962
SCO56_0.86_0.75	-5.02	3.65	-72.67	-5.83	23.94	0.950
SCO57_0.86_0.8	-2.60	2.74	-105.45	-3.26	13.44	0.940
SCO58_0.86_0.85	-0.38	0.63	-165.22	-0.55	2.34	0.931

Table 17. Stochastic Dominance with Respect to a Function for Rankings of Program Net Indemnities for Alternative Levels of STAX and SCO Coverage on a Crosby County Non-Irrigated Cotton Farm

	Efficient Set Based on SDRF at	
	Upper RAC	**0.004**
	Name	Level of Preference
1	STX40_0.9_0.	Most Preferred
2	STX35_0.9_0.	2nd Most Preferred
3	STX39_0.9_0.	3rd Most Preferred
4	STX34_0.9_0.	4th Most Preferred
5	STX45_0.9_0.	5th Most Preferred
6	STX38_0.9_0.	6th Most Preferred
7	STX44_0.9_0.	7th Most Preferred
8	STX33_0.9_0.	8th Most Preferred
9	STX37_0.9_0.	9th Most Preferred
10	STX43_0.9_0.	10th Most Preferred
11	STX32_0.9_0.	11th Most Preferred
12	STX36_0.9_0.	12th Most Preferred
13	STX42_0.9_0.	13th Most Preferred
14	STX31_0.9_0.	14th Most Preferred
15	STX41_0.9_0.	15th Most Preferred
16	STX50_0.9_0.	16th Most Preferred
17	STX49_0.9_0.	17th Most Preferred
18	STX25_0.85_(	18th Most Preferred
19	STX48_0.9_0.	19th Most Preferred
20	STX24_0.85_(	20th Most Preferred
21	STX20_0.85_(	21st Most Preferred
22	STX47_0.9_0.	22nd Most Preferred
23	STX23_0.85_(	23rd Most Preferred
24	STX19_0.85_(	24th Most Preferred
25	STX46_0.9_0.	25th Most Preferred
26	STX18_0.85_(	26th Most Preferred
27	STX22_0.85_(	27th Most Preferred
28	STX30_0.85_(	28th Most Preferred
29	STX17_0.85_(	29th Most Preferred
30	STX21_0.85_(	30th Most Preferred
31	STX29_0.85_(	31st Most Preferred
32	STX16_0.85_(	32nd Most Preferred
33	STX28_0.85_(	33rd Most Preferred
34	STX27_0.85_(	34th Most Preferred
35	STX26_0.85_(	35th Most Preferred
36	STX15_0.8_0.	36th Most Preferred
37	STX14_0.8_0.	37th Most Preferred
38	STX13_0.8_0.	38th Most Preferred
39	STX10_0.8_0.	39th Most Preferred
40	STX12_0.8_0.	40th Most Preferred
41	STX9_0.8_0.7	41st Most Preferred
42	STX11_0.8_0.	42nd Most Preferred
43	STX8_0.8_0.7	43rd Most Preferred
44	STX7_0.8_0.7	44th Most Preferred
45	STX6_0.8_0.7	45th Most Preferred
46	STX1_0.75_0.	46th Most Preferred
47	STX2_0.75_0.	47th Most Preferred
48	STX3_0.75_0.	48th Most Preferred
49	STX4_0.75_0.	49th Most Preferred
50	STX5_0.75_0.	50th Most Preferred
51	SCO58_0.86_(	51st Most Preferred
52	SCO57_0.86_(	52nd Most Preferred
53	SCO56_0.86_(	53rd Most Preferred
54	SCO55_0.86_(	54th Most Preferred
55	SCO54_0.86_(	55th Most Preferred
56	SCO53_0.86_(	56th Most Preferred
57	SCO52_0.86_(	57th Most Preferred
58	SCO51_0.86_(	Least Preferred

Figure 2. Stochastic Efficiency with Respect to a Function for Rankings of Program Net Indemnities for Alternative Levels of STAX and SCO Coverage on a Crosby County Non-Irrigated Cotton Farm



Dawson County

Irrigated

The irrigated cotton farm in Dawson County has non-zero probabilities of receiving negative program net indemnities for STAX and SCO (Table 18). Scenario 35 delivers the largest program net indemnity mean of $144.09/acre, with a 91.2 percent probability of receiving a positive program net indemnity (Table 18). The probability of receiving a positive program net indemnity, high mean value, and low premium cost make Scenario 35 an optimal strategy for a risk neutral decision-maker. However, it is scenario bundle 46 – 50 that has the lowest probability of the program net indemnity being less than zero at 6.6 percent, meaning a 93.4 percent probability that the program net indemnity is positive. Scenarios 46 – 50 have means values far less than scenario bundle 31 – 35 (Table 18). The largest mean value returned by an SCO scenario was Scenario 51 with a program net indemnity mean value of $97.86/acre, but this was closely followed by Scenario 52 with a mean value of $91.76/acre (Table 18). As the means are very close, the differentiating factor for a decision-maker would be the probability for a positive program net indemnity – 80.1 percent and 80 percent respectively (Table 18). However, the positive program net indemnity probability of 86.1 percent (Scenario 58) is much less than the best STAX scenario, based on means (Table 18). While Scenario 51 may be the "optimal" strategy, it is Scenario 58 that returned the lowest probability of a negative net indemnity of the SCO scenarios at 13.9 percent (Table 18). Even though Scenario 58 has low probability of a negative program net indemnity, it has an even lower mean value per acre at $4.87/acre (Table 18).

Based on the SDRF analysis, a rather risk averse decision-maker would most prefer Scenario 35 (Table 19), whereas Scenario 58 was least preferred. Scenario 35 indemnifies the greatest range of liability. Figure 3 depicts the SERF results for ranking the top ten SDRF scenarios. The SERF analysis indicates that Scenario 35 is most preferred regardless of risk aversion level because the certainty equivalent line is much higher than the other nine scenarios (Figure 3). Decision-maker preference remains constant for all scenarios regardless of risk aversion because the CE lines never cross (Figure 3).

Non-Irrigated

The mean values for program net indemnities of non-irrigated cotton in Dawson County were significantly lower than for irrigated cotton due to the lower yielding production practice and greater yield risk. Nevertheless, Scenario 35 provides the largest mean program net indemnity of all scenarios for non-irrigated cotton at $52.71/acre (Table 20). The summary statistics on program net indemnities provided in Table 20 indicate the probability of program net indemnities being less than zero for STAX scenarios ranges from a low of 5.3 percent to a max of 20.5 percent. SCO has an increased probability of returning a negative program net indemnity – 28.5 percent to 9 percent (Table 20). The minimum column in the summary statistics return negative program net indemnity values because a decision-maker may not receive a program indemnity from STAX or SCO that exceeds the premium, and these values represent the premium paid to the program for enrollment (Table 20).

SDRF and SERF risk ranking methods were used to examine a decision-maker's risk ranking preferences for insuring non-irrigated cotton in Dawson County. After identifying the ten most preferred scenarios with SDRF (Table 21), SERF was utilized to rank the top ten scenarios for a range of risk averse decision-makers. Figure 4 depicts the results for SERF rankings, and as with irrigated cotton, Scenario 35 is preferred by all risk-averse decision-makers. Scenarios 31 – 35 are consistently preferred for risk management strategies because of their ability to cover remaining liability. A risk neutral decision-maker with non-irrigated cotton production prefers Scenario 58 (SCO) the least (Table 21). Scenario 58 has a high cost of individual coverage, and only covers one percentage point of liability.

Summary of Dawson County

While the mean values and probabilities of receiving a positive program net indemnity varied between irrigated and non-irrigated production, Scenario 35 resulted in the largest mean value and a high probability of receiving a positive program net indemnity. Scenario bundle 31 – 35 is consistently preferred by both production types because of their large mean values and probabilities of a positive program net indemnity, and further supported by the risk ranking techniques SDRF and SERF. Scenario 58, an SCO strategy, was ranked least preferred by both production types because of low mean values and high probabilities of the program net indemnity being negative. Based on the results the most effective risk management strategy is comprised of utilizing the largest band of subsidized program (STAX/SCO) coverage stacked with the smallest producer elected companion coverage.

Table 18. Summary Statistics of Program Net Indemnities for Alternative Levels of STAX and SCO Coverage on a Dawson County Irrigated Cotton Farm

Variable	Mean	StDev	CV	Min	Max	P(x<0)
STX1_0.75_0.7	19.13	17.30	90.43	-1.49	43.07	0.369
STX2_0.75_0.7	21.52	19.46	90.44	-1.68	48.45	0.369
STX3_0.75_0.7	23.91	21.63	90.46	-1.87	53.83	0.369
STX4_0.75_0.7	26.31	23.79	90.43	-2.05	59.22	0.369
STX5_0.75_0.7	28.69	25.95	90.44	-2.24	64.60	0.369
STX6_0.8_0.7	42.18	31.78	75.33	-3.32	85.80	0.241
STX7_0.8_0.7	47.46	35.75	75.33	-3.73	96.52	0.241
STX8_0.8_0.7	52.74	39.72	75.32	-4.14	107.25	0.241
STX9_0.8_0.7	58.00	43.69	75.33	-4.56	117.97	0.241
STX10_0.8_0.7	63.28	47.66	75.32	-4.97	128.70	0.241
STX11_0.8_0.75	23.06	15.61	67.71	-1.82	42.74	0.239
STX12_0.8_0.75	25.94	17.56	67.71	-2.05	48.08	0.239
STX13_0.8_0.75	28.82	19.52	67.72	-2.28	53.42	0.239
STX14_0.8_0.75	31.71	21.47	67.70	-2.50	58.77	0.239
STX15_0.8_0.75	34.59	23.42	67.71	-2.73	64.11	0.239
STX16_0.85_0.7	67.88	43.87	64.63	-5.43	128.24	0.161
STX17_0.85_0.7	76.37	49.36	64.63	-6.11	144.27	0.161
STX18_0.85_0.7	84.85	54.84	64.63	-6.79	160.30	0.161
STX19_0.85_0.7	93.34	60.32	64.63	-7.47	176.33	0.161
STX20_0.85_0.7	101.83	65.81	64.63	-8.14	192.37	0.161
STX21_0.85_0.75	48.75	28.52	58.50	-3.94	85.18	0.158
STX22_0.85_0.75	54.85	32.09	58.50	-4.43	95.82	0.158
STX23_0.85_0.75	60.94	35.65	58.50	-4.92	106.47	0.158
STX24_0.85_0.75	67.04	39.22	58.49	-5.41	117.12	0.158
STX25_0.85_0.75	73.14	42.78	58.49	-5.90	127.77	0.158
STX26_0.85_0.8	25.69	13.63	53.06	-2.12	42.44	0.155
STX27_0.85_0.8	28.91	15.34	53.05	-2.38	47.75	0.154
STX28_0.85_0.8	32.13	17.04	53.04	-2.64	53.06	0.154
STX29_0.85_0.8	35.33	18.75	53.05	-2.91	58.36	0.155
STX30_0.85_0.8	38.55	20.45	53.05	-3.17	63.67	0.154
STX31_0.9_0.7	96.06	52.59	54.75	-7.80	170.43	0.088
STX32_0.9_0.7	108.07	59.16	54.74	-8.77	191.74	0.088
STX33_0.9_0.7	120.07	65.73	54.75	-9.75	213.04	0.088
STX34_0.9_0.7	132.08	72.31	54.74	-10.72	234.35	0.088
STX35_0.9_0.7	144.09	78.88	54.75	-11.70	255.65	0.088
STX36_0.9_0.75	76.93	37.70	49.01	-6.30	127.37	0.086
STX37_0.9_0.75	86.55	42.42	49.01	-7.09	143.29	0.086
STX38_0.9_0.75	96.16	47.13	49.01	-7.88	159.21	0.086
STX39_0.9_0.75	105.78	51.84	49.01	-8.67	175.13	0.086
STX40_0.9_0.75	115.40	56.55	49.01	-9.45	191.06	0.086
STX41_0.9_0.8	53.73	23.37	43.50	-4.63	84.49	0.078
STX42_0.9_0.8	60.45	26.29	43.49	-5.20	95.05	0.078
STX43_0.9_0.8	67.17	29.21	43.49	-5.78	105.61	0.078
STX44_0.9_0.8	73.88	32.13	43.49	-6.36	116.17	0.078
STX45_0.9_0.8	80.59	35.06	43.50	-6.94	126.73	0.078
STX46_0.9_0.85	28.01	10.52	37.56	-2.53	42.03	0.066
STX47_0.9_0.85	31.52	11.84	37.55	-2.84	47.29	0.066
STX48_0.9_0.85	35.02	13.15	37.56	-3.16	52.54	0.066
STX49_0.9_0.85	38.52	14.47	37.56	-3.48	57.79	0.066
STX50_0.9_0.85	42.02	15.78	37.56	-3.79	63.05	0.066
SCO51_0.86_0.5	91.86	83.18	90.55	-20.10	290.95	0.199
SCO52_0.86_0.55	91.76	80.59	87.83	-18.77	255.02	0.190
SCO53_0.86_0.6	87.68	72.27	82.42	-17.10	212.53	0.186
SCO54_0.86_0.65	79.28	59.99	75.67	-14.93	170.54	0.177
SCO55_0.86_0.7	66.45	45.59	68.61	-12.28	132.33	0.168
SCO56_0.86_0.75	49.08	30.47	62.08	-9.16	90.26	0.155
SCO57_0.86_0.8	28.15	15.84	56.26	-5.37	48.86	0.146
SCO58_0.86_0.85	4.87	2.47	50.70	-0.99	8.05	0.139

Table 19. Stochastic Dominance with Respect to a Function for Rankings of Program Net Indemnities for Alternative Levels of STAX and SCO Coverage on a Dawson County Irrigated Cotton Farm

	Efficient Set Based on SDRF at	
	Upper RAC	**0.0019**
	Name	Level of Preference
1	STX35_0.9_0.	Most Preferred
2	STX34_0.9_0.	2nd Most Preferred
3	STX33_0.9_0.	3rd Most Preferred
4	STX40_0.9_0.	4th Most Preferred
5	STX32_0.9_0.	5th Most Preferred
6	STX39_0.9_0.	6th Most Preferred
7	STX20_0.85_(	7th Most Preferred
8	STX38_0.9_0.	8th Most Preferred
9	STX31_0.9_0.	9th Most Preferred
10	STX19_0.85_(	10th Most Preferred
11	SCO52_0.86_	11th Most Preferred
12	SCO51_0.86_	12th Most Preferred
13	STX37_0.9_0.	13th Most Preferred
14	SCO53_0.86_	14th Most Preferred
15	STX18_0.85_(	15th Most Preferred
16	STX45_0.9_0.	16th Most Preferred
17	SCO54_0.86_	17th Most Preferred
18	STX36_0.9_0.	18th Most Preferred
19	STX17_0.85_(	19th Most Preferred
20	STX44_0.9_0.	20th Most Preferred
21	STX25_0.85_(	21st Most Preferred
22	STX43_0.9_0.	22nd Most Preferred
23	STX16_0.85_(	23rd Most Preferred
24	STX24_0.85_(	24th Most Preferred
25	SCO55_0.86_	25th Most Preferred
26	STX10_0.8_0.	26th Most Preferred
27	STX42_0.9_0.	27th Most Preferred
28	STX23_0.85_(	28th Most Preferred
29	STX9_0.8_0.7	29th Most Preferred
30	STX22_0.85_(	30th Most Preferred
31	STX41_0.9_0.	31st Most Preferred
32	STX8_0.8_0.7	32nd Most Preferred
33	SCO56_0.86_	33rd Most Preferred
34	STX21_0.85_(	34th Most Preferred
35	STX7_0.8_0.7	35th Most Preferred
36	STX50_0.9_0.	36th Most Preferred
37	STX6_0.8_0.7	37th Most Preferred
38	STX49_0.9_0.	38th Most Preferred
39	STX30_0.85_(	39th Most Preferred
40	STX29_0.85_(	40th Most Preferred
41	STX48_0.9_0.	41st Most Preferred
42	STX15_0.8_0.	42nd Most Preferred
43	STX28_0.85_(	43rd Most Preferred
44	STX47_0.9_0.	44th Most Preferred
45	STX14_0.8_0.	45th Most Preferred
46	STX27_0.85_(	46th Most Preferred
47	STX13_0.8_0.	47th Most Preferred
48	STX5_0.75_0.	48th Most Preferred
49	STX46_0.9_0.	49th Most Preferred
50	SCO57_0.86_	50th Most Preferred
51	STX4_0.75_0.	51st Most Preferred
52	STX12_0.8_0.	52nd Most Preferred
53	STX26_0.85_(	53rd Most Preferred
54	STX3_0.75_0.	54th Most Preferred
55	STX11_0.8_0.	55th Most Preferred
56	STX2_0.75_0.	56th Most Preferred
57	STX1_0.75_0.	57th Most Preferred
58	SCO58_0.86_	Least Preferred

Figure 3. Stochastic Efficiency with Respect to a Function for Rankings of Program Net Indemnities for Alternative Levels of STAX and SCO Coverage on a Dawson County Irrigated Cotton Farm

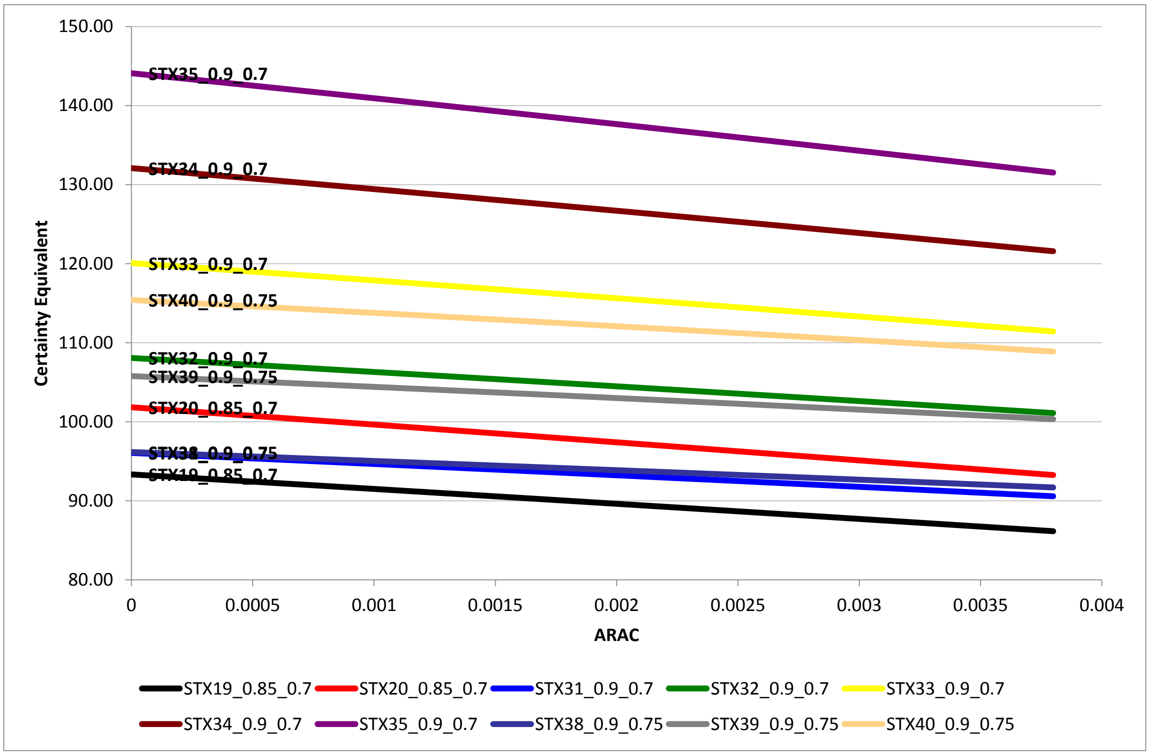


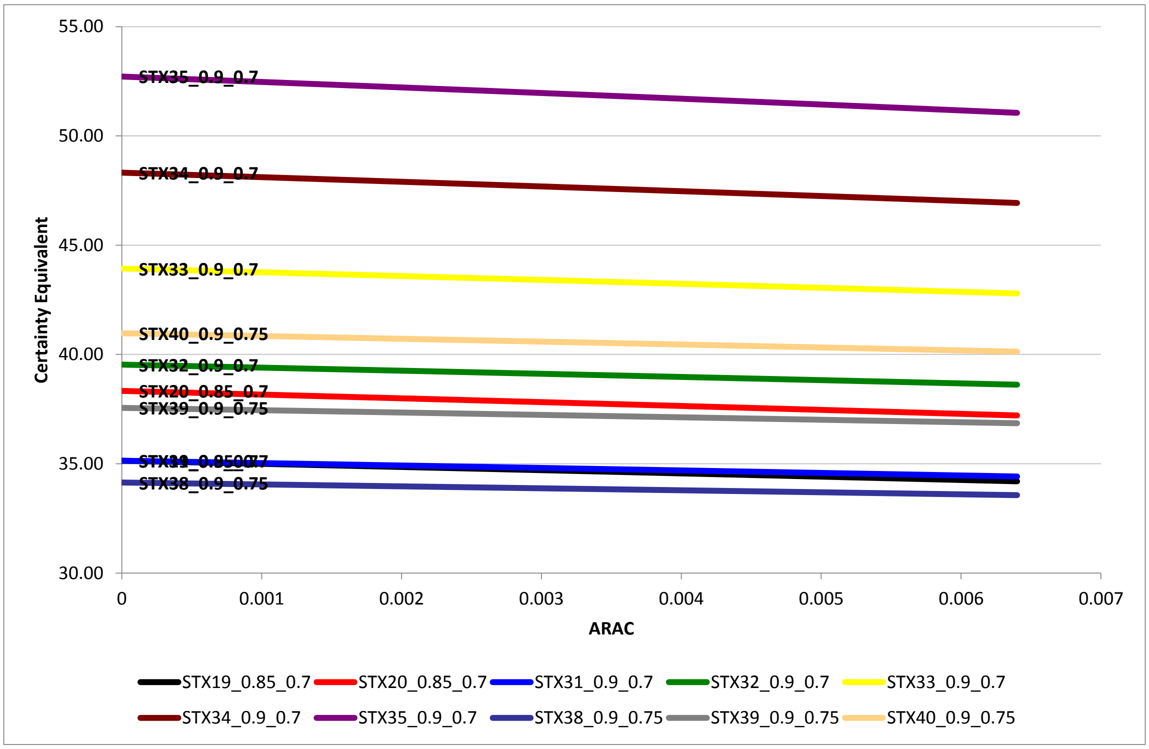
Table 20. Summary Statistics of Program Net Indemnities for Alternative Levels of STAX and SCO Coverage on a Dawson County Non-Irrigated Cotton Farm

Variable	Mean	StDev	CV	Min	Max	P(x<0)
STX1_0.75_0.7	7.83	4.85	61.99	-0.67	14.03	0.205
STX2_0.75_0.7	8.81	5.46	61.96	-0.75	15.79	0.205
STX3_0.75_0.7	9.79	6.06	61.94	-0.83	17.55	0.205
STX4_0.75_0.7	10.76	6.67	61.98	-0.92	19.29	0.205
STX5_0.75_0.7	11.74	7.28	61.96	-1.00	21.05	0.205
STX6_0.8_0.7	16.42	8.90	54.24	-1.40	28.00	0.154
STX7_0.8_0.7	18.46	10.02	54.26	-1.58	31.50	0.155
STX8_0.8_0.7	20.52	11.13	54.24	-1.75	35.00	0.154
STX9_0.8_0.7	22.58	12.24	54.23	-1.92	38.51	0.154
STX10_0.8_0.7	24.62	13.36	54.24	-2.10	42.00	0.154
STX11_0.8_0.75	8.59	4.33	50.37	-0.73	13.97	0.151
STX12_0.8_0.75	9.66	4.87	50.37	-0.82	15.72	0.151
STX13_0.8_0.75	10.73	5.41	50.41	-0.92	17.46	0.151
STX14_0.8_0.75	11.80	5.95	50.40	-1.01	19.20	0.151
STX15_0.8_0.75	12.88	6.49	50.39	-1.10	20.95	0.151
STX16_0.85_0.7	25.55	12.20	47.75	-2.18	41.92	0.104
STX17_0.85_0.7	28.74	13.73	47.75	-2.45	47.16	0.104
STX18_0.85_0.7	31.94	15.25	47.75	-2.72	52.41	0.104
STX19_0.85_0.7	35.14	16.78	47.74	-2.99	57.65	0.104
STX20_0.85_0.7	38.33	18.30	47.74	-3.26	62.89	0.104
STX21_0.85_0.75	17.72	7.83	44.21	-1.51	27.89	0.101
STX22_0.85_0.75	19.94	8.81	44.21	-1.70	31.38	0.101
STX23_0.85_0.75	22.15	9.79	44.21	-1.89	34.86	0.101
STX24_0.85_0.75	24.37	10.77	44.20	-2.07	38.36	0.101
STX25_0.85_0.75	26.59	11.75	44.20	-2.26	41.84	0.101
STX26_0.85_0.8	9.13	3.73	40.82	-0.78	13.92	0.098
STX27_0.85_0.8	10.28	4.19	40.79	-0.87	15.67	0.098
STX28_0.85_0.8	11.42	4.66	40.81	-0.97	17.41	0.098
STX29_0.85_0.8	12.56	5.13	40.82	-1.07	19.14	0.098
STX30_0.85_0.8	13.71	5.59	40.79	-1.16	20.89	0.098
STX31_0.9_0.7	35.14	14.72	41.89	-2.99	55.81	0.063
STX32_0.9_0.7	39.53	16.56	41.88	-3.36	62.79	0.063
STX33_0.9_0.7	43.93	18.40	41.88	-3.73	69.77	0.063
STX34_0.9_0.7	48.32	20.24	41.88	-4.11	76.74	0.063
STX35_0.9_0.7	52.71	22.08	41.88	-4.48	83.72	0.063
STX36_0.9_0.75	27.31	10.51	38.49	-2.32	41.78	0.061
STX37_0.9_0.75	30.73	11.83	38.49	-2.61	47.00	0.061
STX38_0.9_0.75	34.14	13.14	38.49	-2.90	52.23	0.061
STX39_0.9_0.75	37.55	14.46	38.49	-3.19	57.45	0.061
STX40_0.9_0.75	40.97	15.77	38.49	-3.48	62.67	0.061
STX41_0.9_0.8	18.73	6.59	35.16	-1.58	27.82	0.059
STX42_0.9_0.8	21.07	7.41	35.17	-1.78	31.30	0.059
STX43_0.9_0.8	23.41	8.23	35.17	-1.98	34.77	0.059
STX44_0.9_0.8	25.75	9.06	35.17	-2.18	38.25	0.059
STX45_0.9_0.8	28.09	9.88	35.18	-2.38	41.72	0.059
STX46_0.9_0.85	9.59	3.07	31.96	-0.81	13.89	0.053
STX47_0.9_0.85	10.79	3.45	31.96	-0.91	15.63	0.053
STX48_0.9_0.85	11.99	3.83	31.95	-1.01	17.37	0.053
STX49_0.9_0.85	13.19	4.21	31.95	-1.11	19.10	0.053
STX50_0.9_0.85	14.39	4.60	31.95	-1.21	20.84	0.053
SCO51_0.86_0.5	9.94	16.17	162.76	-18.23	41.35	0.285
SCO52_0.86_0.55	10.42	14.39	138.18	-16.16	35.72	0.251
SCO53_0.86_0.6	10.24	12.09	118.01	-13.78	29.73	0.220
SCO54_0.86_0.65	9.32	9.64	103.37	-11.32	23.82	0.186
SCO55_0.86_0.7	7.70	7.13	92.61	-8.82	17.96	0.165
SCO56_0.86_0.75	5.50	4.72	85.86	-6.31	12.46	0.138
SCO57_0.86_0.8	3.10	2.45	79.03	-3.54	6.70	0.114
SCO58_0.86_0.85	0.52	0.39	73.59	-0.61	1.10	0.090

Table 21. Stochastic Dominance with Respect to a Function for Rankings of Program Net Indemnities for Alternative Levels of STAX and SCO Coverage on a Dawson County Non-Irrigated Cotton Farm

	Efficient Set Based on SDRF at	
	Upper RAC	**0.0032**
	Name	Level of Preference
1	STX35_0.9_0.	Most Preferred
2	STX34_0.9_0.	2nd Most Preferred
3	STX33_0.9_0.	3rd Most Preferred
4	STX40_0.9_0.	4th Most Preferred
5	STX32_0.9_0.	5th Most Preferred
6	STX20_0.85_(	6th Most Preferred
7	STX39_0.9_0.	7th Most Preferred
8	STX31_0.9_0.	8th Most Preferred
9	STX19_0.85_(	9th Most Preferred
10	STX38_0.9_0.	10th Most Preferred
11	STX18_0.85_(	11th Most Preferred
12	STX37_0.9_0.	12th Most Preferred
13	STX17_0.85_(	13th Most Preferred
14	STX45_0.9_0.	14th Most Preferred
15	STX36_0.9_0.	15th Most Preferred
16	STX25_0.85_(	16th Most Preferred
17	STX44_0.9_0.	17th Most Preferred
18	STX16_0.85_(	18th Most Preferred
19	STX10_0.8_0.	19th Most Preferred
20	STX24_0.85_(	20th Most Preferred
21	STX43_0.9_0.	21st Most Preferred
22	STX9_0.8_0.7	22nd Most Preferred
23	STX23_0.85_(	23rd Most Preferred
24	STX42_0.9_0.	24th Most Preferred
25	STX8_0.8_0.7	25th Most Preferred
26	STX22_0.85_(	26th Most Preferred
27	STX41_0.9_0.	27th Most Preferred
28	STX7_0.8_0.7	28th Most Preferred
29	STX21_0.85_(	29th Most Preferred
30	STX6_0.8_0.7	30th Most Preferred
31	STX50_0.9_0.	31st Most Preferred
32	STX30_0.85_(	32nd Most Preferred
33	STX49_0.9_0.	33rd Most Preferred
34	STX15_0.8_0.	34th Most Preferred
35	STX29_0.85_(	35th Most Preferred
36	STX48_0.9_0.	36th Most Preferred
37	STX14_0.8_0.	37th Most Preferred
38	STX5_0.75_0.	38th Most Preferred
39	STX28_0.85_(	39th Most Preferred
40	STX47_0.9_0.	40th Most Preferred
41	STX4_0.75_0.	41st Most Preferred
42	STX13_0.8_0.	42nd Most Preferred
43	STX27_0.85_(	43rd Most Preferred
44	SCO52_0.86_(	44th Most Preferred
45	SCO53_0.86_(	45th Most Preferred
46	STX3_0.75_0.	46th Most Preferred
47	STX12_0.8_0.	47th Most Preferred
48	STX46_0.9_0.	48th Most Preferred
49	SCO51_0.86_(	49th Most Preferred
50	SCO54_0.86_(	50th Most Preferred
51	STX26_0.85_(	51st Most Preferred
52	STX2_0.75_0.	52nd Most Preferred
53	STX11_0.8_0.	53rd Most Preferred
54	STX1_0.75_0.	54th Most Preferred
55	SCO55_0.86_(	55th Most Preferred
56	SCO56_0.86_(	56th Most Preferred
57	SCO57_0.86_(	57th Most Preferred
58	SCO58_0.86_(	Least Preferred

Figure 4. Stochastic Efficiency with Respect to a Function for Rankings of Program Net Indemnities for Alternative Levels of STAX and SCO Coverage on a Dawson County Non-Irrigated Cotton Farm



Hill County

Non-Irrigated

Hill County is located in northern central Texas, and receives an average of 34 – 38 inches of precipitation per year. With this amount of rainfall, non-irrigated is the predominant cotton production in Hill County.

The largest mean value for program net indemnity was Scenario 35 ($91.89/acre) with a 95.0 percent probability of receiving a positive program net indemnity (Table 22). Scenario bundle 31 – 35 returned a probability of 95.0 percent of receiving a positive program net indemnity (Table 22). But, it is scenario bundle 46 – 50 that returns the lowest probability of a negative program net indemnity at 4.4 percent (Table 22). One of the least preferred bundles is Scenarios 1 – 5 because of the high threshold loss and small range of coverage – five percentage points. Scenarios 1 – 5 have the greatest probabilities of program net indemnity being less than zero at 35.3 percent (Table 22). Scenarios 51 – 58 have a mean range of $45.75/acre down to $2.55/acre, and probabilities of positive program net indemnities of 86.6 percent up to 92.6 percent (Table 22). Even with positive means and probabilities, SCO is not preferred to the STAX scenarios by risk neutral decision-makers (Table 23). High cost and low coverage discourages decision-makers from SCO.

SDRF analysis was utilized to rank all scenarios from most to least preferred. Scenario 35 was most preferred and the least preferred was Scenario 58 (Table 23). From SDRF the top ten most preferred were ranked using SERF. As depicted in Figure 5, Scenario 35 is ranked first for all risk averse decision makers. SERF risk rankings remain generally do not change across risk aversion levels because the CE lines do not cross. The CE lines for 32 and 39 do not have an intersection, but lay upon each other indicating the decision-maker has little preference for one over the other. Refer to Table 22 for detailed summary statistics of Scenarios 32 and 39.

In summary, all scenarios have non-zero probabilities that program net indemnity is less than zero (Table 22). There is a possibility that a program net indemnity will not be received, and this is represented by the minimum values being negative (Table 22). The negative minimum values represent the premium paid by the decision-maker. However, on average the producer should receive a positive program net indemnity and this is supported by all mean values being positive and all scenarios having 35.5 percent probability or greater of receiving a positive program net indemnity (Table 22). The mean values for program net indemnity are consistent with other non-irrigated means of the study. Risk ranking is similar to other non-irrigated production with Scenario 35 ranking first (Table 23 and Figure 5).

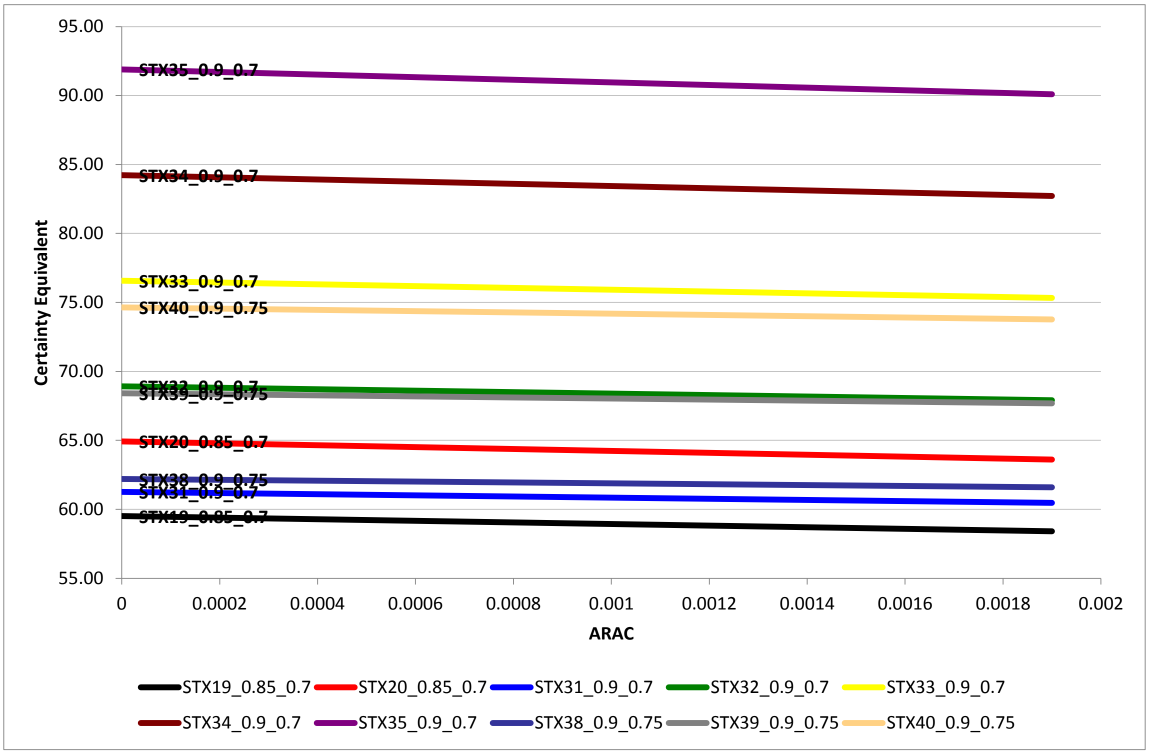
Table 22. Summary Statistics of Program Net Indemnities for Alternative Levels of STAX and SCO Coverage on a Hill County Non-Irrigated Cotton Farm

Variable	Mean	StDev	CV	Min	Max	P(x<0)
STX1_0.75_0.7	11.50	10.49	91.25	-0.90	26.69	0.353
STX2_0.75_0.7	12.94	11.81	91.23	-1.01	30.03	0.353
STX3_0.75_0.7	14.37	13.12	91.28	-1.13	33.36	0.353
STX4_0.75_0.7	15.81	14.43	91.26	-1.24	36.70	0.353
STX5_0.75_0.7	17.25	15.74	91.24	-1.35	40.04	0.353
STX6_0.8_0.7	26.43	18.60	70.38	-2.05	53.14	0.196
STX7_0.8_0.7	29.73	20.92	70.39	-2.31	59.77	0.196
STX8_0.8_0.7	33.02	23.25	70.40	-2.57	66.41	0.196
STX9_0.8_0.7	36.33	25.57	70.38	-2.82	73.06	0.196
STX10_0.8_0.7	39.63	27.90	70.39	-3.08	79.70	0.196
STX11_0.8_0.75	14.92	9.01	60.40	-1.15	26.44	0.190
STX12_0.8_0.75	16.78	10.14	60.42	-1.30	29.74	0.190
STX13_0.8_0.75	18.65	11.27	60.40	-1.44	33.05	0.190
STX14_0.8_0.75	20.52	12.39	60.39	-1.58	36.36	0.190
STX15_0.8_0.75	22.38	13.52	60.41	-1.73	39.66	0.190
STX16_0.85_0.7	43.29	24.64	56.93	-3.51	79.27	0.108
STX17_0.85_0.7	48.69	27.72	56.93	-3.95	89.18	0.108
STX18_0.85_0.7	54.10	30.80	56.93	-4.39	99.08	0.108
STX19_0.85_0.7	59.51	33.88	56.93	-4.83	108.99	0.108
STX20_0.85_0.7	64.92	36.96	56.93	-5.27	118.90	0.108
STX21_0.85_0.75	31.78	15.61	49.13	-2.61	52.58	0.105
STX22_0.85_0.75	35.75	17.57	49.13	-2.94	59.14	0.105
STX23_0.85_0.75	39.73	19.52	49.12	-3.26	65.72	0.105
STX24_0.85_0.75	43.70	21.47	49.13	-3.59	72.29	0.105
STX25_0.85_0.75	47.68	23.42	49.12	-3.91	78.87	0.105
STX26_0.85_0.8	16.86	7.22	42.83	-1.46	26.13	0.098
STX27_0.85_0.8	18.97	8.12	42.83	-1.64	29.40	0.098
STX28_0.85_0.8	21.08	9.03	42.82	-1.82	32.67	0.098
STX29_0.85_0.8	23.18	9.93	42.84	-2.01	35.93	0.098
STX30_0.85_0.8	25.29	10.83	42.83	-2.19	39.20	0.098
STX31_0.9_0.7	61.26	28.75	46.93	-5.25	105.12	0.050
STX32_0.9_0.7	68.92	32.34	46.93	-5.91	118.26	0.050
STX33_0.9_0.7	76.57	35.94	46.93	-6.57	131.40	0.050
STX34_0.9_0.7	84.23	39.53	46.93	-7.23	144.53	0.050
STX35_0.9_0.7	91.89	43.13	46.93	-7.88	157.68	0.050
STX36_0.9_0.75	49.76	19.98	40.15	-4.35	78.43	0.049
STX37_0.9_0.75	55.98	22.48	40.16	-4.90	88.23	0.049
STX38_0.9_0.75	62.20	24.98	40.15	-5.44	98.03	0.049
STX39_0.9_0.75	68.42	27.47	40.16	-5.99	107.83	0.049
STX40_0.9_0.75	74.64	29.97	40.15	-6.53	117.64	0.049
STX41_0.9_0.8	34.84	11.92	34.23	-3.20	51.99	0.048
STX42_0.9_0.8	39.19	13.41	34.23	-3.60	58.48	0.048
STX43_0.9_0.8	43.55	14.91	34.23	-4.00	64.98	0.048
STX44_0.9_0.8	47.90	16.40	34.23	-4.40	71.48	0.048
STX45_0.9_0.8	52.26	17.89	34.23	-4.80	77.98	0.048
STX46_0.9_0.85	17.97	5.27	29.31	-1.75	25.84	0.044
STX47_0.9_0.85	20.21	5.92	29.31	-1.97	29.07	0.044
STX48_0.9_0.85	22.46	6.58	29.31	-2.19	32.30	0.044
STX49_0.9_0.85	24.70	7.24	29.31	-2.41	35.53	0.044
STX50_0.9_0.85	26.95	7.90	29.31	-2.63	38.76	0.044
SCO51_0.86_0.5	45.75	37.82	82.66	-9.92	142.60	0.134
SCO52_0.86_0.55	45.58	36.69	80.49	-9.54	125.87	0.129
SCO53_0.86_0.6	44.15	33.48	75.83	-8.97	105.37	0.127
SCO54_0.86_0.65	40.46	27.86	68.86	-8.13	84.35	0.122
SCO55_0.86_0.7	34.26	20.70	60.43	-6.93	63.53	0.109
SCO56_0.86_0.75	25.82	13.45	52.10	-5.30	44.29	0.106
SCO57_0.86_0.8	14.82	6.74	45.45	-3.23	23.82	0.095
SCO58_0.86_0.85	2.55	0.99	38.74	-0.59	3.92	0.074

Table 23. Stochastic Dominance with Respect to a Function for Rankings of Program Net Indemnities for Alternative Levels of STAX and SCO Coverage on a Hill County Non-Irrigated Cotton Farm

	Efficient Set Based on SDRF at	
	Upper RAC	**0.00097**
	Name	Level of Preference
1	STX35_0.9_0.	Most Preferred
2	STX34_0.9_0.	2nd Most Preferred
3	STX33_0.9_0.	3rd Most Preferred
4	STX40_0.9_0.	4th Most Preferred
5	STX32_0.9_0.	5th Most Preferred
6	STX39_0.9_0.	6th Most Preferred
7	STX20_0.85_(	7th Most Preferred
8	STX38_0.9_0.	8th Most Preferred
9	STX31_0.9_0.	9th Most Preferred
10	STX19_0.85_(	10th Most Preferred
11	STX37_0.9_0.	11th Most Preferred
12	STX18_0.85_(	12th Most Preferred
13	STX45_0.9_0.	13th Most Preferred
14	STX36_0.9_0.	14th Most Preferred
15	STX17_0.85_(	15th Most Preferred
16	STX44_0.9_0.	16th Most Preferred
17	STX25_0.85_(	17th Most Preferred
18	SCO51_0.86_(	18th Most Preferred
19	SCO52_0.86_(	19th Most Preferred
20	SCO53_0.86_(	20th Most Preferred
21	STX24_0.85_(	21st Most Preferred
22	STX43_0.9_0.	22nd Most Preferred
23	STX16_0.85_(	23rd Most Preferred
24	SCO54_0.86_(	24th Most Preferred
25	STX23_0.85_(	25th Most Preferred
26	STX10_0.8_0.	26th Most Preferred
27	STX42_0.9_0.	27th Most Preferred
28	STX9_0.8_0.7	28th Most Preferred
29	STX22_0.85_(	29th Most Preferred
30	STX41_0.9_0.	30th Most Preferred
31	SCO55_0.86_(	31st Most Preferred
32	STX8_0.8_0.7	32nd Most Preferred
33	STX21_0.85_(	33rd Most Preferred
34	STX7_0.8_0.7	34th Most Preferred
35	STX50_0.9_0.	35th Most Preferred
36	STX6_0.8_0.7	36th Most Preferred
37	SCO56_0.86_(	37th Most Preferred
38	STX30_0.85_(	38th Most Preferred
39	STX49_0.9_0.	39th Most Preferred
40	STX29_0.85_(	40th Most Preferred
41	STX48_0.9_0.	41st Most Preferred
42	STX15_0.8_0.	42nd Most Preferred
43	STX28_0.85_(	43rd Most Preferred
44	STX14_0.8_0.	44th Most Preferred
45	STX47_0.9_0.	45th Most Preferred
46	STX27_0.85_(	46th Most Preferred
47	STX13_0.8_0.	47th Most Preferred
48	STX46_0.9_0.	48th Most Preferred
49	STX5_0.75_0.	49th Most Preferred
50	STX26_0.85_(	50th Most Preferred
51	STX12_0.8_0.	51st Most Preferred
52	STX4_0.75_0.	52nd Most Preferred
53	STX11_0.8_0.	53rd Most Preferred
54	SCO57_0.86_(	54th Most Preferred
55	STX3_0.75_0.	55th Most Preferred
56	STX2_0.75_0.	56th Most Preferred
57	STX1_0.75_0.	57th Most Preferred
58	SCO58_0.86_(	Least Preferred

Figure 5. Stochastic Efficiency with Respect to a Function for Rankings of Program Net Indemnities for Alternative Levels of STAX and SCO Coverage on a Hill County Non-Irrigated Cotton Farm



Moore County

Irrigated

Of the four counties with irrigated cotton production, Moore County had some of the largest mean values for the program net indemnity. The largest mean value was represented by Scenario 35 ($153.83/acre) and the lowest was for Scenario 58 ($3.37/acre) (Table 24). Moore County had a probability of 25.3 percent or higher of receiving a positive program net indemnity (Table 24). The increased values and range of summary statistics could be attributed to high historical county yields.

Risk ranking techniques, SDRF and SERF were used to rank the preferences of the scenarios. SDRF was analyzed as a rather risk averse decision-maker, and with the selected preference resulted in Scenario 35 being most preferred and Scenario 58 least preferred (Table 25). To further refine the top ten SDRF scenarios, SERF was utilized. SERF rankings were based on risk-averse decision-makers, and Scenario 35 was ranked highest (Figure 6). Rankings are constant for the majority of the top ten scenarios for all risk adverse decision makers because the CE line do not touch or cross. However, Scenarios 19, 31, and 38 have similar risk ranking preferences for a decision-maker because they are lay upon one another (Figure 6).

Non-Irrigated

Non-irrigated cotton production in Moore County has non-zero probabilities of a negative program net indemnity for all 58 scenarios (Table 26). The highest probability of receiving a positive program net indemnity (88.9 percent) is observed in scenario bundle 46 – 50 (Table 26). Scenario 35 has the largest mean value at $67.25/acre (Table

26). As in other counties with non-irrigated production, SCO scenarios do provide risk management assistance, but are not preferred. Scenario 51 offered the highest return for the mean value ($41.65/acre), but it was Scenario 58 (SCO) that returned the lowest probability that the program net indemnity will be less than zero (Table 26). Resulting in Scenario 58 having an 82.2 percent probability of receiving a positive program net indemnity.

SDRF ranked the 58 scenarios from the most preferred, Scenario 35, to the least preferred, Scenario 58 (Table 27). In the SERF analysis, Scenario 35 and 34 are ranked first and second, respectively, and are preferred across all risk aversion levels (Figure 7). However, several scenarios do change rankings depending on the decision-makers' ARAC, as depicted in Figure 7 their CE lines cross or lay on top of one another. Nevertheless, Scenario 35 was most preferred by SDRF and SERF for all risk-averse decision-makers.

Summary of Moore County

When compared to the other counties in the study, Moore County had similar findings as other Texas counties that have irrigated and non-irrigated production types. Scenario 35 was most preferred because of its high mean for value for the program net indemnity and relatively high probability of returning a positive program net indemnity. Scenario bundle 31 – 35 is preferred over other scenarios for both STAX and SCO. However, scenario bundle 46 – 50 does continuously give the highest probability of returning a positive program net indemnity, but this bundle only covers a five percentage point range of liability (90 percent STAX threshold and 85 percent individual coverage). SCO scenarios do provide coverage, but with lower mean values and probability of positive program net indemnity, and coupled with high premiums making them less preferred to STAX scenarios.

Table 24. Summary Statistics of Program Net Indemnities for Alternative Levels of STAX and SCO Coverage on a Moore County Irrigated Cotton Farm

Variable	Mean	StDev	CV	Min	Max	Prob(x<0)
STX1_0.75_0.7	21.15	15.02	71.04	-0.72	41.54	0.253
STX2_0.75_0.7	23.78	16.90	71.07	-0.82	46.73	0.253
STX3_0.75_0.7	26.42	18.78	71.07	-0.91	51.92	0.253
STX4_0.75_0.7	29.06	20.66	71.07	-1.00	57.11	0.253
STX5_0.75_0.7	31.71	22.53	71.06	-1.09	62.31	0.253
STX6_0.8_0.7	46.62	26.13	56.04	-1.59	82.94	0.141
STX7_0.8_0.7	52.44	29.39	56.05	-1.79	93.30	0.141
STX8_0.8_0.7	58.27	32.66	56.05	-1.99	103.67	0.141
STX9_0.8_0.7	64.09	35.92	56.05	-2.19	114.04	0.141
STX10_0.8_0.7	69.92	39.19	56.05	-2.39	124.40	0.141
STX11_0.8_0.75	25.39	12.26	48.29	-0.95	41.31	0.140
STX12_0.8_0.75	28.56	13.79	48.29	-1.07	46.48	0.140
STX13_0.8_0.75	31.74	15.33	48.29	-1.19	51.64	0.140
STX14_0.8_0.75	34.91	16.86	48.30	-1.31	56.80	0.140
STX15_0.8_0.75	38.08	18.39	48.30	-1.43	61.97	0.140
STX16_0.85_0.7	74.26	34.01	45.80	-2.96	123.83	0.072
STX17_0.85_0.7	83.54	38.26	45.80	-3.33	139.31	0.072
STX18_0.85_0.7	92.82	42.51	45.80	-3.70	154.79	0.072
STX19_0.85_0.7	102.11	46.76	45.80	-4.07	170.27	0.072
STX20_0.85_0.7	111.39	51.02	45.80	-4.44	185.75	0.072
STX21_0.85_0.75	53.02	20.86	39.33	-2.33	82.20	0.070
STX22_0.85_0.75	59.65	23.46	39.33	-2.62	92.47	0.070
STX23_0.85_0.75	66.28	26.07	39.33	-2.91	102.75	0.070
STX24_0.85_0.75	72.90	28.68	39.34	-3.21	113.02	0.070
STX25_0.85_0.75	79.53	31.28	39.34	-3.50	123.29	0.070
STX26_0.85_0.8	27.63	9.49	34.33	-1.38	40.88	0.069
STX27_0.85_0.8	31.09	10.67	34.33	-1.55	46.00	0.069
STX28_0.85_0.8	34.55	11.86	34.33	-1.72	51.11	0.069
STX29_0.85_0.8	38.00	13.04	34.33	-1.89	56.22	0.069
STX30_0.85_0.8	41.46	14.23	34.32	-2.06	61.34	0.069
STX31_0.9_0.7	102.55	40.02	39.03	-4.95	164.10	0.044
STX32_0.9_0.7	115.38	45.03	39.03	-5.56	184.63	0.044
STX33_0.9_0.7	128.19	50.03	39.03	-6.18	205.14	0.044
STX34_0.9_0.7	141.01	55.03	39.03	-6.80	225.65	0.044
STX35_0.9_0.7	153.83	60.03	39.03	-7.42	246.16	0.044
STX36_0.9_0.75	81.41	27.32	33.55	-4.22	122.57	0.044
STX37_0.9_0.75	91.59	30.73	33.55	-4.75	137.89	0.044
STX38_0.9_0.75	101.77	34.15	33.55	-5.27	153.22	0.044
STX39_0.9_0.75	111.95	37.56	33.55	-5.80	168.54	0.044
STX40_0.9_0.75	122.12	40.97	33.55	-6.33	183.86	0.044
STX41_0.9_0.8	55.94	16.54	29.56	-3.35	81.18	0.044
STX42_0.9_0.8	62.93	18.61	29.56	-3.77	91.32	0.044
STX43_0.9_0.8	69.93	20.67	29.57	-4.19	101.47	0.044
STX44_0.9_0.8	76.92	22.74	29.57	-4.61	111.62	0.044
STX45_0.9_0.8	83.91	24.81	29.57	-5.03	121.76	0.044
STX46_0.9_0.85	28.30	7.64	26.98	-1.98	40.28	0.041
STX47_0.9_0.85	31.84	8.59	26.98	-2.23	45.32	0.041
STX48_0.9_0.85	35.37	9.54	26.98	-2.48	50.35	0.041
STX49_0.9_0.85	38.91	10.50	26.99	-2.73	55.38	0.041
STX50_0.9_0.85	42.45	11.45	26.98	-2.97	60.43	0.041
SCO51_0.86_0.5	76.07	52.55	69.08	-10.14	197.64	0.081
SCO52_0.86_0.55	74.54	49.88	66.92	-10.08	171.23	0.081
SCO53_0.86_0.6	70.18	43.88	62.53	-9.93	144.46	0.080
SCO54_0.86_0.65	62.15	35.22	56.67	-9.68	118.16	0.079
SCO55_0.86_0.7	51.38	25.44	49.51	-8.49	88.98	0.077
SCO56_0.86_0.75	37.33	16.05	42.98	-6.81	60.20	0.073
SCO57_0.86_0.8	20.75	7.97	38.40	-4.44	32.11	0.069
SCO58_0.86_0.85	3.37	1.23	36.48	-0.93	5.16	0.063

Table 35. Stochastic Dominance with Respect to a Function for Rankings of Program Net Indemnities for Alternative Levels of STAX and SCO Coverage on a Moore County Irrigated Cotton Farm

	Efficient Set Based on SDRF at	
	Upper RAC	**0.0012**
	Name	Level of Preference
1	STX35_0.9_0.	Most Preferred
2	STX34_0.9_0.	2nd Most Preferred
3	STX33_0.9_0.	3rd Most Preferred
4	STX40_0.9_0.	4th Most Preferred
5	STX32_0.9_0.	5th Most Preferred
6	STX39_0.9_0.	6th Most Preferred
7	STX20_0.85_(	7th Most Preferred
8	STX31_0.9_0.	8th Most Preferred
9	STX38_0.9_0.	9th Most Preferred
10	STX19_0.85_(	10th Most Preferred
11	STX18_0.85_(	11th Most Preferred
12	STX37_0.9_0.	12th Most Preferred
13	STX45_0.9_0.	13th Most Preferred
14	STX17_0.85_(	14th Most Preferred
15	STX36_0.9_0.	15th Most Preferred
16	STX25_0.85_(	16th Most Preferred
17	STX44_0.9_0.	17th Most Preferred
18	SCO51_0.86_	18th Most Preferred
19	STX16_0.85_(	19th Most Preferred
20	SCO52_0.86_	20th Most Preferred
21	STX24_0.85_(	21st Most Preferred
22	STX43_0.9_0.	22nd Most Preferred
23	SCO53_0.86_	23rd Most Preferred
24	STX10_0.8_0.	24th Most Preferred
25	STX23_0.85_(	25th Most Preferred
26	STX9_0.8_0.7	26th Most Preferred
27	STX42_0.9_0.	27th Most Preferred
28	SCO54_0.86_	28th Most Preferred
29	STX22_0.85_(	29th Most Preferred
30	STX8_0.8_0.7	30th Most Preferred
31	STX41_0.9_0.	31st Most Preferred
32	STX21_0.85_(	32nd Most Preferred
33	STX7_0.8_0.7	33rd Most Preferred
34	SCO55_0.86_	34th Most Preferred
35	STX6_0.8_0.7	35th Most Preferred
36	STX50_0.9_0.	36th Most Preferred
37	STX30_0.85_(	37th Most Preferred
38	STX49_0.9_0.	38th Most Preferred
39	STX29_0.85_(	39th Most Preferred
40	STX15_0.8_0.	40th Most Preferred
41	SCO56_0.86_	41st Most Preferred
42	STX48_0.9_0.	42nd Most Preferred
43	STX14_0.8_0.	43rd Most Preferred
44	STX28_0.85_(	44th Most Preferred
45	STX47_0.9_0.	45th Most Preferred
46	STX13_0.8_0.	46th Most Preferred
47	STX5_0.75_0.	47th Most Preferred
48	STX27_0.85_(	48th Most Preferred
49	STX4_0.75_0.	49th Most Preferred
50	STX12_0.8_0.	50th Most Preferred
51	STX46_0.9_0.	51st Most Preferred
52	STX26_0.85_(	52nd Most Preferred
53	STX3_0.75_0.	53rd Most Preferred
54	STX11_0.8_0.	54th Most Preferred
55	STX2_0.75_0.	55th Most Preferred
56	STX1_0.75_0.	56th Most Preferred
57	SCO57_0.86_	57th Most Preferred
58	SCO58_0.86_	Least Preferred

Figure 6. Stochastic Efficiency with Respect to a Function for Rankings of Program Net Indemnities for Alternative Levels of STAX and SCO Coverage on a Moore County Irrigated Cotton Farm

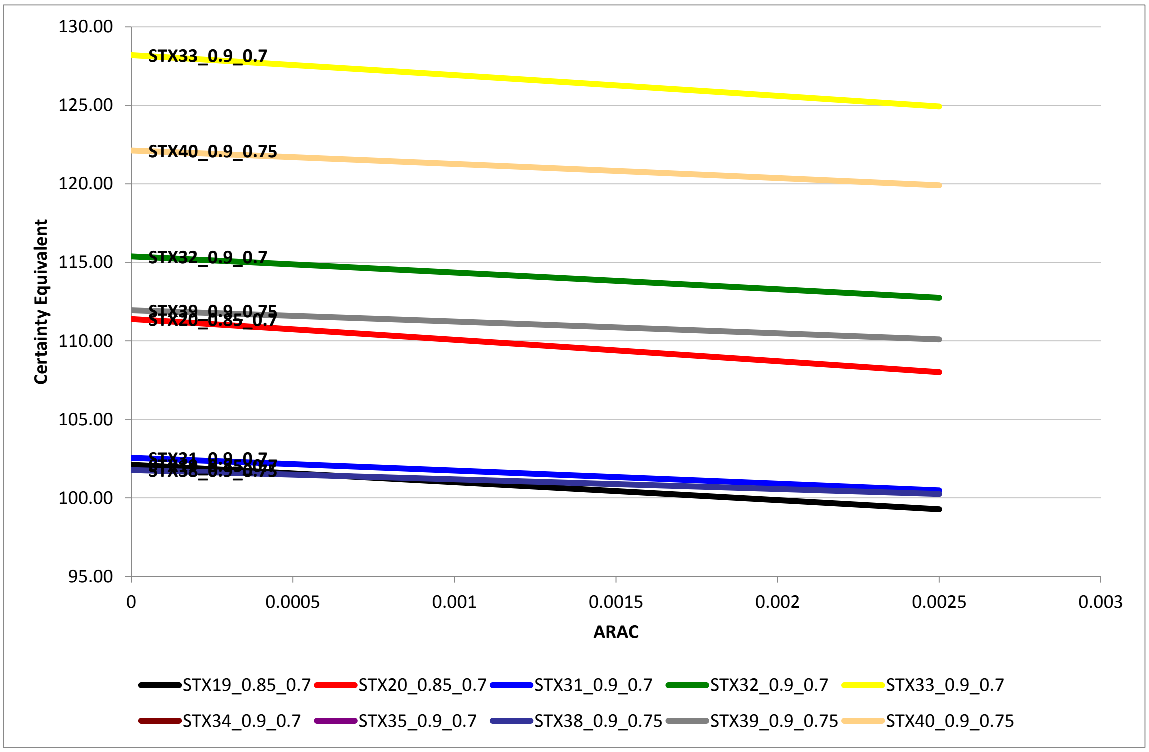


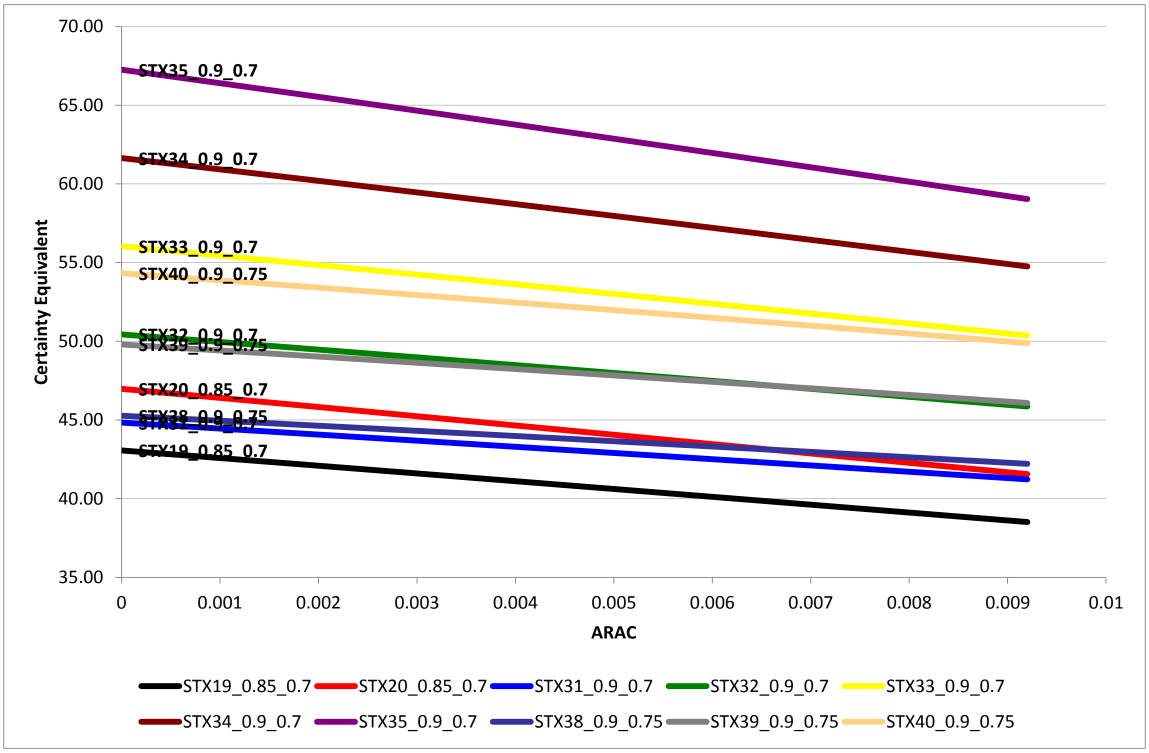
Table 26. Summary Statistics of Program Net Indemnities for Alternative Levels of STAX and SCO Coverage on a Moore County Non-Irrigated Cotton Farm

Variable	Mean	StDev	CV	Min	Max	Prob(x<0)
STX1_0.75_0.7	8.62	8.65	100.27	-0.69	22.29	0.421
STX2_0.75_0.7	9.70	9.73	100.31	-0.78	25.07	0.421
STX3_0.75_0.7	10.77	10.81	100.34	-0.87	27.86	0.421
STX4_0.75_0.7	11.85	11.89	100.28	-0.95	30.65	0.421
STX5_0.75_0.7	12.93	12.97	100.31	-1.04	33.43	0.421
STX6_0.8_0.7	19.09	16.31	85.43	-1.47	44.49	0.304
STX7_0.8_0.7	21.48	18.35	85.41	-1.65	50.06	0.304
STX8_0.8_0.7	23.87	20.39	85.40	-1.83	55.62	0.304
STX9_0.8_0.7	26.25	22.43	85.42	-2.02	61.18	0.304
STX10_0.8_0.7	28.64	24.47	85.41	-2.20	66.74	0.304
STX11_0.8_0.75	10.48	8.15	77.81	-0.77	22.21	0.295
STX12_0.8_0.75	11.79	9.17	77.83	-0.87	24.98	0.295
STX13_0.8_0.75	13.09	10.19	77.85	-0.97	27.76	0.295
STX14_0.8_0.75	14.41	11.21	77.81	-1.06	30.54	0.295
STX15_0.8_0.75	15.72	12.23	77.83	-1.16	33.31	0.295
STX16_0.85_0.7	31.32	22.60	72.15	-2.32	66.62	0.202
STX17_0.85_0.7	35.23	25.42	72.15	-2.61	74.95	0.202
STX18_0.85_0.7	39.15	28.24	72.15	-2.90	83.28	0.202
STX19_0.85_0.7	43.06	31.07	72.15	-3.19	91.61	0.202
STX20_0.85_0.7	46.98	33.89	72.15	-3.48	99.93	0.202
STX21_0.85_0.75	22.70	14.84	65.39	-1.63	44.33	0.199
STX22_0.85_0.75	25.54	16.70	65.38	-1.83	49.88	0.199
STX23_0.85_0.75	28.38	18.55	65.37	-2.03	55.42	0.199
STX24_0.85_0.75	31.21	20.41	65.39	-2.24	60.96	0.199
STX25_0.85_0.75	34.05	22.26	65.38	-2.44	66.50	0.199
STX26_0.85_0.8	12.23	7.18	58.77	-0.85	22.13	0.194
STX27_0.85_0.8	13.75	8.08	58.78	-0.96	24.89	0.194
STX28_0.85_0.8	15.27	8.98	58.80	-1.07	27.66	0.194
STX29_0.85_0.8	16.81	9.88	58.77	-1.17	30.43	0.194
STX30_0.85_0.8	18.33	10.78	58.78	-1.28	33.19	0.194
STX31_0.9_0.7	44.83	27.51	61.35	-3.27	88.65	0.119
STX32_0.9_0.7	50.44	30.94	61.36	-3.68	99.73	0.119
STX33_0.9_0.7	56.04	34.38	61.36	-4.09	110.81	0.119
STX34_0.9_0.7	61.64	37.82	61.36	-4.50	121.90	0.119
STX35_0.9_0.7	67.25	41.26	61.35	-4.90	132.99	0.119
STX36_0.9_0.75	36.21	20.04	55.33	-2.58	66.36	0.117
STX37_0.9_0.75	40.74	22.54	55.33	-2.90	74.66	0.117
STX38_0.9_0.75	45.27	25.05	55.33	-3.22	82.96	0.117
STX39_0.9_0.75	49.80	27.55	55.33	-3.54	91.26	0.117
STX40_0.9_0.75	54.33	30.06	55.32	-3.86	99.55	0.117
STX41_0.9_0.8	25.74	12.73	49.45	-1.80	44.16	0.116
STX42_0.9_0.8	28.95	14.32	49.46	-2.03	49.68	0.116
STX43_0.9_0.8	32.17	15.91	49.45	-2.25	55.20	0.116
STX44_0.9_0.8	35.39	17.50	49.46	-2.48	60.72	0.116
STX45_0.9_0.8	38.61	19.09	49.45	-2.70	66.24	0.116
STX46_0.9_0.85	13.51	5.96	44.09	-0.95	22.03	0.111
STX47_0.9_0.85	15.20	6.70	44.10	-1.07	24.78	0.111
STX48_0.9_0.85	16.89	7.45	44.10	-1.19	27.54	0.111
STX49_0.9_0.85	18.58	8.19	44.10	-1.31	30.29	0.111
STX50_0.9_0.85	20.28	8.94	44.08	-1.42	33.05	0.111
SCO51_0.86_0.5	41.65	43.07	103.41	-10.31	141.59	0.237
SCO52_0.86_0.55	40.72	39.88	97.93	-9.32	121.48	0.229
SCO53_0.86_0.6	38.78	35.54	91.66	-8.24	101.98	0.222
SCO54_0.86_0.65	35.17	29.79	84.69	-7.02	85.25	0.213
SCO55_0.86_0.7	29.61	22.85	77.17	-5.63	64.67	0.202
SCO56_0.86_0.75	22.17	15.46	69.75	-4.08	44.25	0.195
SCO57_0.86_0.8	13.03	8.15	62.56	-2.34	24.02	0.182
SCO58_0.86_0.85	2.30	1.29	56.38	-0.41	3.98	0.172

Table 27. Stochastic Dominance with Respect to a Function for Rankings of Program Net Indemnities for Alternative Levels of STAX and SCO Coverage on a Moore County Non-Irrigated Cotton Farm

	Efficient Set Based on SDRF at	
	Upper RAC	**0.0046**
	Name	Level of Preference
1	STX35_0.9_0.	Most Preferred
2	STX34_0.9_0.	2nd Most Preferred
3	STX33_0.9_0.	3rd Most Preferred
4	STX40_0.9_0.	4th Most Preferred
5	STX32_0.9_0.	5th Most Preferred
6	STX39_0.9_0.	6th Most Preferred
7	STX20_0.85_(	7th Most Preferred
8	STX38_0.9_0.	8th Most Preferred
9	STX31_0.9_0.	9th Most Preferred
10	STX19_0.85_(	10th Most Preferred
11	STX37_0.9_0.	11th Most Preferred
12	STX45_0.9_0.	12th Most Preferred
13	SCO51_0.86_(	13th Most Preferred
14	STX18_0.85_(	14th Most Preferred
15	SCO52_0.86_(	15th Most Preferred
16	SCO53_0.86_(	16th Most Preferred
17	STX36_0.9_0.	17th Most Preferred
18	STX44_0.9_0.	18th Most Preferred
19	STX17_0.85_(	19th Most Preferred
20	SCO54_0.86_(	20th Most Preferred
21	STX25_0.85_(	21st Most Preferred
22	STX43_0.9_0.	22nd Most Preferred
23	STX24_0.85_(	23rd Most Preferred
24	STX16_0.85_(	24th Most Preferred
25	STX42_0.9_0.	25th Most Preferred
26	SCO55_0.86_(	26th Most Preferred
27	STX23_0.85_(	27th Most Preferred
28	STX10_0.8_0.	28th Most Preferred
29	STX41_0.9_0.	29th Most Preferred
30	STX9_0.8_0.7	30th Most Preferred
31	STX22_0.85_(	31st Most Preferred
32	STX8_0.8_0.7	32nd Most Preferred
33	STX21_0.85_(	33rd Most Preferred
34	SCO56_0.86_(	34th Most Preferred
35	STX7_0.8_0.7	35th Most Preferred
36	STX50_0.9_0.	36th Most Preferred
37	STX6_0.8_0.7	37th Most Preferred
38	STX49_0.9_0.	38th Most Preferred
39	STX30_0.85_(	39th Most Preferred
40	STX48_0.9_0.	40th Most Preferred
41	STX29_0.85_(	41st Most Preferred
42	STX15_0.8_0.	42nd Most Preferred
43	STX47_0.9_0.	43rd Most Preferred
44	STX28_0.85_(	44th Most Preferred
45	STX14_0.8_0.	45th Most Preferred
46	STX27_0.85_(	46th Most Preferred
47	STX46_0.9_0.	47th Most Preferred
48	SCO57_0.86_(	48th Most Preferred
49	STX13_0.8_0.	49th Most Preferred
50	STX5_0.75_0.	50th Most Preferred
51	STX26_0.85_(	51st Most Preferred
52	STX12_0.8_0.	52nd Most Preferred
53	STX4_0.75_0.	53rd Most Preferred
54	STX3_0.75_0.	54th Most Preferred
55	STX11_0.8_0.	55th Most Preferred
56	STX2_0.75_0.	56th Most Preferred
57	STX1_0.75_0.	57th Most Preferred
58	SCO58_0.86_(	Least Preferred

Figure 7. Stochastic Efficiency with Respect to a Function for Rankings of Program Net Indemnities for Alternative Levels of STAX and SCO Coverage on a Moore County Non-Irrigated Cotton Farm



Mississippi County, Arkansas

Irrigated

Mississippi County, Arkansas located in far northeast Arkansas near the Mississippi River is included in the study for two reasons:

1. How does STAX and SCO compare in another state?
2. How does basis from the futures market affect program net indemnity?

All STAX and SCO strategies have non-zero probabilities that the program net indemnities will be negative (Table 28). Scenario 35 resulted in the largest mean value for program net indemnity at $89.39/acre, and the smallest mean value was for Scenario 58 at $4.87/acre (Table 28). The wide range in means is an indication of the many management choices a decision-maker will have to examine to determine their optimal strategy for effective risk management. The minimum column in Table 28 has negative values for all scenarios. Negative values in the minimum column indicate that the cost of the premium exceeds the program indemnity. Irrigated cotton has a 31.8 percent probability or greater of being paid a positive program net indemnity across all scenarios. Scenario bundle 46 – 50 had the greatest probability of receiving a positive program net indemnity at 73.3 percent (Table 28).

Using SDRF, the 58 scenarios were ranked from most preferred to least preferred, with Scenario 35 being most preferred (Table 29). A full list of rankings can be seen in Table 29. The top ten rankings were analyzed using SERF, and Scenario 35 was the most preferred for risk-averse decision-makers regardless of risk aversion level because the certainty equivalent lines never cross (Figure 8).

Non-Irrigated

The probability of receiving a positive program net indemnity for non-irrigated cotton is low compared with irrigated cotton in Mississippi County. Scenario bundle 46 – 50 had the highest probability of a positive program net indemnity at 28.4 percent, resulting in a 71.6 percent probability that the program net indemnity will be less than zero (Table 30). Scenarios 1 – 5 represent the highest probabilities for a negative program net indemnity at 99.3 percent (Table 30). The largest mean value for program net indemnity was Scenario 45 ($7.90/acre) (Table 30). Several of the mean values for the program net indemnity are negative indicating no positive return to the decision-maker, or that the program premium paid was larger than the program net indemnity received.

Using an upper RAC of .0011 for SDRF, Scenario 45 was most preferred and Scenario 51 was least preferred (Table 31). The top ten scenarios were ranked using SERF (upper RAC equals .0023). Scenario 45 was ranked first, for all risk-averse decision-maker's preferences (Figure 9). As depicted in Figure 9, there is some preference change in preferred scenario depending on the decision-makers' ARAC.

Summary of Mississippi County, Arkansas

As expected, the irrigated mean program net indemnity values are higher than for those of non-irrigated production. Decision-makers based on production practice preferred different risk management strategies, and this is supported by the summary statistics and risk ranking preferences. Scenario 35 had the largest mean for irrigated cotton and Scenario 45 for non-irrigated. Scenario bundle 46 – 50 returned the greatest probability that the program net indemnity would be greater than zero.

The risk ranking preferences for scenarios vary among the production types. SDRF ranks Scenario 35 as most preferred for irrigated and Scenario 45 most preferred non-irrigated for rather risk averse decision-makers. Scenarios 1 – 5 and Scenario 58 are least preferred for both production types because they indemnify very little liability and/or have a high probability of a negative program net indemnity. As shown in the SERF figures, Scenario 35 rather handily ranks first for all risk-averse decision-makers, with no real close second for irrigated cotton. This is a similar finding for Scenario 45 in non-irrigated production.

Table 28. Summary Statistics of Program Net Indemnities for Alternative Levels of STAX and SCO Coverage on a Mississippi County, AR Irrigated Cotton Farm

Variable	Mean	StDev	CV	Min	Max	Prob(x<0)
STX1_0.75_0.7	7.63	14.11	184.83	-0.82	37.17	0.682
STX2_0.75_0.7	8.59	15.87	184.77	-0.92	41.82	0.682
STX3_0.75_0.7	9.54	17.63	184.92	-1.03	46.46	0.682
STX4_0.75_0.7	10.49	19.40	184.87	-1.13	51.11	0.682
STX5_0.75_0.7	11.45	21.16	184.83	-1.23	55.76	0.682
STX6_0.8_0.7	20.73	28.84	139.12	-1.93	74.05	0.524
STX7_0.8_0.7	23.32	32.44	139.11	-2.17	83.31	0.524
STX8_0.8_0.7	25.91	36.05	139.11	-2.41	92.57	0.524
STX9_0.8_0.7	28.51	39.65	139.10	-2.65	101.82	0.524
STX10_0.8_0.7	31.10	43.26	139.10	-2.89	111.08	0.524
STX11_0.8_0.75	13.00	16.29	125.34	-1.21	37.18	0.522
STX12_0.8_0.75	14.62	18.33	125.33	-1.36	41.83	0.522
STX13_0.8_0.75	16.25	20.36	125.32	-1.51	46.48	0.522
STX14_0.8_0.75	17.87	22.40	125.31	-1.66	51.13	0.522
STX15_0.8_0.75	19.49	24.43	125.37	-1.82	55.77	0.522
STX16_0.85_0.7	38.23	42.85	112.09	-3.67	110.30	0.394
STX17_0.85_0.7	43.00	48.21	112.10	-4.13	124.09	0.394
STX18_0.85_0.7	47.78	53.56	112.10	-4.59	137.87	0.394
STX19_0.85_0.7	52.56	58.92	112.10	-5.05	151.66	0.394
STX20_0.85_0.7	57.34	64.28	112.10	-5.51	165.45	0.394
STX21_0.85_0.75	30.48	31.43	103.10	-2.96	73.82	0.387
STX22_0.85_0.75	34.31	35.36	103.07	-3.32	83.06	0.387
STX23_0.85_0.75	38.12	39.29	103.07	-3.69	92.29	0.387
STX24_0.85_0.75	41.93	43.22	103.07	-4.06	101.51	0.387
STX25_0.85_0.75	45.74	47.14	103.08	-4.43	110.74	0.387
STX26_0.85_0.8	17.50	16.50	94.32	-1.74	36.65	0.382
STX27_0.85_0.8	19.68	18.57	94.33	-1.96	41.23	0.382
STX28_0.85_0.8	21.87	20.63	94.34	-2.18	45.81	0.382
STX29_0.85_0.8	24.05	22.69	94.35	-2.40	50.39	0.382
STX30_0.85_0.8	26.24	24.76	94.35	-2.62	54.97	0.382
STX31_0.9_0.7	59.60	55.02	92.31	-6.03	145.93	0.274
STX32_0.9_0.7	67.04	61.89	92.32	-6.79	164.17	0.274
STX33_0.9_0.7	74.49	68.77	92.32	-7.54	182.41	0.274
STX34_0.9_0.7	81.94	75.65	92.32	-8.30	200.65	0.274
STX35_0.9_0.7	89.39	82.52	92.32	-9.05	218.89	0.274
STX36_0.9_0.75	51.85	44.41	85.65	-5.32	109.85	0.272
STX37_0.9_0.75	58.34	49.96	85.64	-5.98	123.59	0.272
STX38_0.9_0.75	64.82	55.51	85.65	-6.65	137.31	0.272
STX39_0.9_0.75	71.31	61.07	85.64	-7.31	151.05	0.272
STX40_0.9_0.75	77.78	66.62	85.65	-7.98	164.78	0.272
STX41_0.9_0.8	38.86	30.57	78.68	-4.11	72.67	0.270
STX42_0.9_0.8	43.72	34.40	78.67	-4.62	81.76	0.270
STX43_0.9_0.8	48.58	38.22	78.67	-5.13	90.85	0.270
STX44_0.9_0.8	53.43	42.04	78.68	-5.65	99.92	0.270
STX45_0.9_0.8	58.29	45.86	78.67	-6.16	109.01	0.270
STX46_0.9_0.85	21.37	15.41	72.13	-2.36	36.03	0.267
STX47_0.9_0.85	24.04	17.34	72.15	-2.66	40.53	0.267
STX48_0.9_0.85	26.71	19.27	72.13	-2.95	45.04	0.267
STX49_0.9_0.85	29.38	21.20	72.15	-3.25	49.54	0.267
STX50_0.9_0.85	32.05	23.12	72.13	-3.54	54.05	0.267
SCO51_0.86_0.5	55.39	66.38	119.83	-8.29	219.66	0.378
SCO52_0.86_0.55	55.44	66.38	119.72	-8.24	219.71	0.377
SCO53_0.86_0.6	55.63	66.38	119.31	-8.05	219.90	0.377
SCO54_0.86_0.65	55.49	65.27	117.63	-7.69	193.39	0.377
SCO55_0.86_0.7	51.74	57.66	111.45	-7.00	147.58	0.374
SCO56_0.86_0.75	42.25	43.41	102.75	-5.77	100.50	0.364
SCO57_0.86_0.8	26.28	24.77	94.26	-3.71	54.26	0.361
SCO58_0.86_0.85	4.87	4.20	86.31	-0.72	8.95	0.352

Table 29. Stochastic Dominance with Respect to a Function for Rankings of Program Net Indemnities for Alternative Levels of STAX and SCO Coverage on a Mississippi County, AR Irrigated Cotton Farm

	Efficient Set Based on SDRF at	
	Upper RAC	**0.00098**
	Name	Level of Preference
1	STX35_0.9_0.	Most Preferred
2	STX34_0.9_0.	2nd Most Preferred
3	STX40_0.9_0.	3rd Most Preferred
4	STX33_0.9_0.	4th Most Preferred
5	STX39_0.9_0.	5th Most Preferred
6	STX32_0.9_0.	6th Most Preferred
7	STX38_0.9_0.	7th Most Preferred
8	STX31_0.9_0.	8th Most Preferred
9	STX45_0.9_0.	9th Most Preferred
10	STX37_0.9_0.	10th Most Preferred
11	STX20_0.85_(	11th Most Preferred
12	SCO53_0.86_	12th Most Preferred
13	SCO54_0.86_	13th Most Preferred
14	SCO52_0.86_	14th Most Preferred
15	SCO51_0.86_	15th Most Preferred
16	STX44_0.9_0.	16th Most Preferred
17	STX36_0.9_0.	17th Most Preferred
18	STX19_0.85_(	18th Most Preferred
19	SCO55_0.86_	19th Most Preferred
20	STX43_0.9_0.	20th Most Preferred
21	STX18_0.85_(	21st Most Preferred
22	STX25_0.85_(	22nd Most Preferred
23	STX42_0.9_0.	23rd Most Preferred
24	STX17_0.85_(	24th Most Preferred
25	SCO56_0.86_	25th Most Preferred
26	STX24_0.85_(	26th Most Preferred
27	STX41_0.9_0.	27th Most Preferred
28	STX23_0.85_(	28th Most Preferred
29	STX16_0.85_(	29th Most Preferred
30	STX22_0.85_(	30th Most Preferred
31	STX50_0.9_0.	31st Most Preferred
32	STX10_0.8_0.	32nd Most Preferred
33	STX21_0.85_(	33rd Most Preferred
34	STX49_0.9_0.	34th Most Preferred
35	STX9_0.8_0.7	35th Most Preferred
36	STX48_0.9_0.	36th Most Preferred
37	SCO57_0.86_	37th Most Preferred
38	STX30_0.85_(	38th Most Preferred
39	STX8_0.8_0.7	39th Most Preferred
40	STX47_0.9_0.	40th Most Preferred
41	STX29_0.85_(	41st Most Preferred
42	STX7_0.8_0.7	42nd Most Preferred
43	STX28_0.85_(	43rd Most Preferred
44	STX46_0.9_0.	44th Most Preferred
45	STX6_0.8_0.7	45th Most Preferred
46	STX27_0.85_(	46th Most Preferred
47	STX15_0.8_0.	47th Most Preferred
48	STX14_0.8_0.	48th Most Preferred
49	STX26_0.85_(	49th Most Preferred
50	STX13_0.8_0.	50th Most Preferred
51	STX12_0.8_0.	51st Most Preferred
52	STX11_0.8_0.	52nd Most Preferred
53	STX5_0.75_0.	53rd Most Preferred
54	STX4_0.75_0.	54th Most Preferred
55	STX3_0.75_0.	55th Most Preferred
56	STX2_0.75_0.	56th Most Preferred
57	STX1_0.75_0.	57th Most Preferred
58	SCO58_0.86_	Least Preferred

Figure 8. Stochastic Efficiency with Respect to a Function for Rankings of Program Net Indemnities for Alternative Levels of STAX and SCO Coverage on a Mississippi County, AR Irrigated Cotton Farm

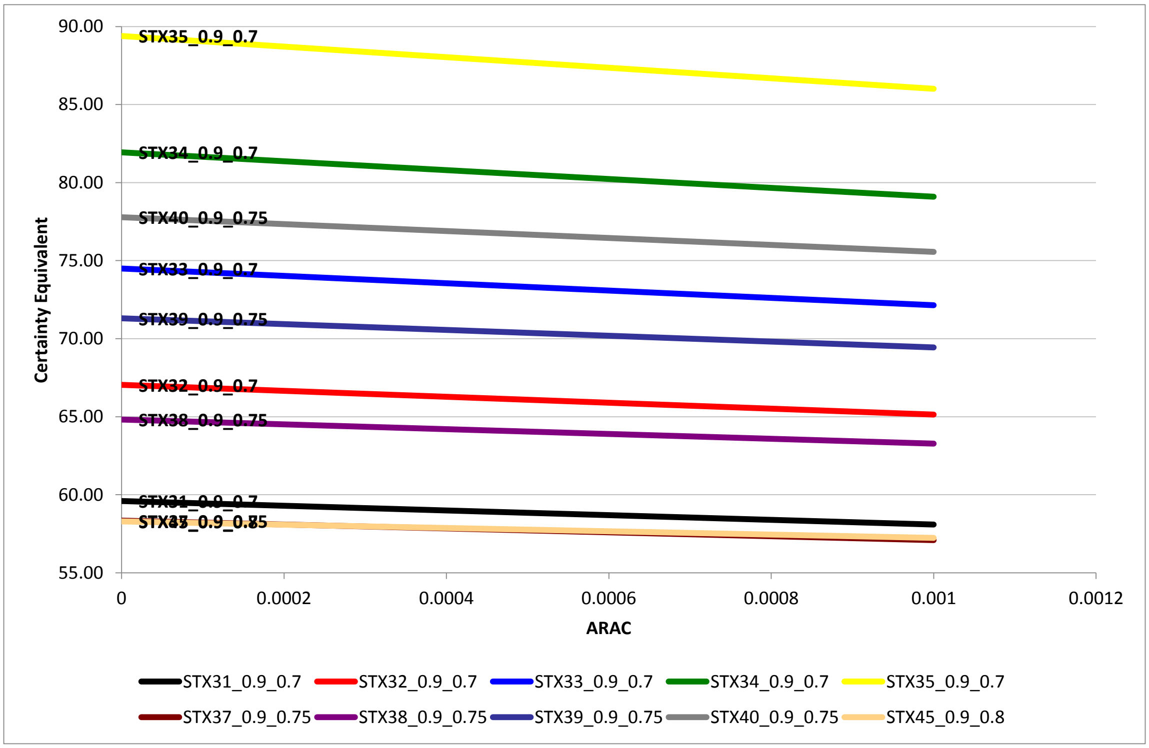


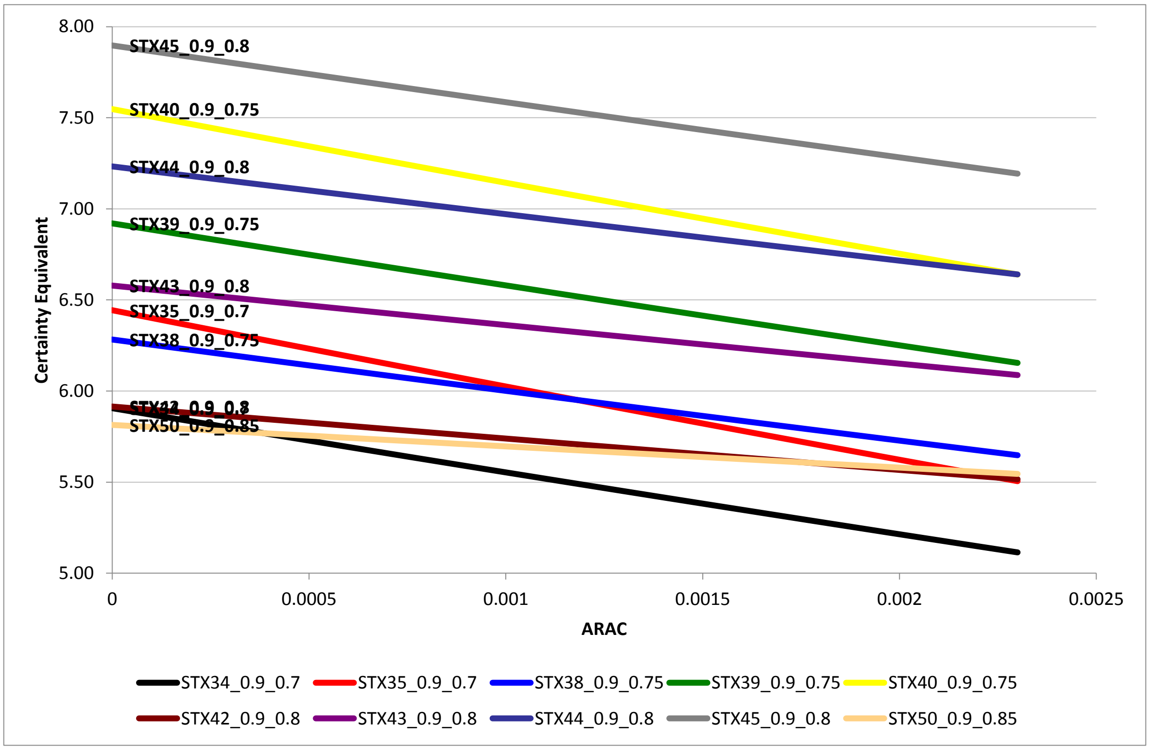
Table 30. Summary Statistics of Program Net Indemnities for Alternative Levels of STAX and SCO Coverage on a Mississippi County, AR Non-Irrigated Cotton Farm

Variable	Mean	StDev	CV	Min	Max	Prob(x<0)
STX1_0.75_0.7	-0.74	1.28	-174.57	-0.82	25.89	0.993
STX2_0.75_0.7	-0.83	1.45	-175.09	-0.92	29.13	0.993
STX3_0.75_0.7	-0.91	1.61	-175.54	-1.02	32.37	0.993
STX4_0.75_0.7	-1.00	1.77	-175.83	-1.12	35.60	0.993
STX5_0.75_0.7	-1.10	1.93	-174.53	-1.23	38.83	0.993
STX6_0.8_0.7	-0.97	4.48	-462.22	-1.88	51.54	0.935
STX7_0.8_0.7	-1.08	5.04	-464.34	-2.11	57.98	0.935
STX8_0.8_0.7	-1.21	5.60	-462.24	-2.35	64.42	0.935
STX9_0.8_0.7	-1.33	6.16	-463.95	-2.58	70.87	0.935
STX10_0.8_0.7	-1.45	6.72	-462.21	-2.82	77.31	0.935
STX11_0.8_0.75	-0.23	3.76	-1613.51	-1.06	25.65	0.934
STX12_0.8_0.75	-0.26	4.23	-1629.21	-1.19	28.86	0.934
STX13_0.8_0.75	-0.30	4.70	-1586.47	-1.33	32.06	0.934
STX14_0.8_0.75	-0.32	5.17	-1600.78	-1.46	35.26	0.934
STX15_0.8_0.75	-0.35	5.64	-1613.54	-1.59	38.47	0.934
STX16_0.85_0.7	0.42	10.88	2614.03	-3.51	76.62	0.841
STX17_0.85_0.7	0.47	12.24	2620.68	-3.95	86.19	0.841
STX18_0.85_0.7	0.52	13.60	2626.16	-4.39	95.77	0.841
STX19_0.85_0.7	0.57	14.96	2630.82	-4.83	105.34	0.841
STX20_0.85_0.7	0.63	16.32	2593.22	-5.26	114.93	0.841
STX21_0.85_0.75	1.15	10.42	904.21	-2.69	50.73	0.835
STX22_0.85_0.75	1.29	11.72	906.78	-3.03	57.06	0.835
STX23_0.85_0.75	1.43	13.02	908.90	-3.37	63.40	0.835
STX24_0.85_0.75	1.58	14.32	904.87	-3.70	69.75	0.835
STX25_0.85_0.75	1.72	15.63	906.81	-4.04	76.09	0.835
STX26_0.85_0.8	1.39	7.49	540.59	-1.63	25.18	0.829
STX27_0.85_0.8	1.56	8.42	539.26	-1.83	28.33	0.829
STX28_0.85_0.8	1.73	9.36	541.35	-2.04	31.47	0.829
STX29_0.85_0.8	1.91	10.29	540.22	-2.24	34.62	0.829
STX30_0.85_0.8	2.07	11.23	541.88	-2.45	37.76	0.829
STX31_0.9_0.7	4.29	19.50	454.33	-5.69	101.14	0.734
STX32_0.9_0.7	4.83	21.94	454.20	-6.40	113.79	0.734
STX33_0.9_0.7	5.37	24.38	454.11	-7.11	126.43	0.734
STX34_0.9_0.7	5.91	26.81	454.03	-7.82	139.08	0.734
STX35_0.9_0.7	6.44	29.25	453.97	-8.53	151.72	0.734
STX36_0.9_0.75	5.03	19.16	381.01	-4.87	75.26	0.733
STX37_0.9_0.75	5.66	21.55	381.09	-5.48	84.66	0.733
STX38_0.9_0.75	6.28	23.95	381.16	-6.09	94.07	0.733
STX39_0.9_0.75	6.92	26.34	380.66	-6.69	103.48	0.733
STX40_0.9_0.75	7.55	28.74	380.75	-7.30	112.89	0.733
STX41_0.9_0.8	5.26	16.77	318.76	-3.81	49.80	0.725
STX42_0.9_0.8	5.91	18.87	318.96	-4.29	56.02	0.725
STX43_0.9_0.8	6.58	20.96	318.63	-4.76	62.26	0.725
STX44_0.9_0.8	7.23	23.06	318.81	-5.24	68.48	0.725
STX45_0.9_0.8	7.90	25.15	318.55	-5.71	74.71	0.725
STX46_0.9_0.85	3.88	10.28	265.21	-2.18	24.65	0.716
STX47_0.9_0.85	4.36	11.56	265.06	-2.45	27.73	0.716
STX48_0.9_0.85	4.85	12.85	264.93	-2.72	30.82	0.716
STX49_0.9_0.85	5.34	14.13	264.83	-2.99	33.90	0.716
STX50_0.9_0.85	5.81	15.42	265.21	-3.27	36.97	0.716
SCO51_0.86_0.5	-5.49	17.90	-325.91	-12.53	111.19	0.841
SCO52_0.86_0.55	-5.47	17.90	-327.10	-12.51	111.21	0.841
SCO53_0.86_0.6	-5.38	17.90	-332.57	-12.42	111.30	0.841
SCO54_0.86_0.65	-4.85	17.90	-368.90	-11.89	111.83	0.839
SCO55_0.86_0.7	-3.49	17.86	-512.15	-10.52	110.36	0.834
SCO56_0.86_0.75	-1.41	17.25	-1225.77	-8.32	74.80	0.825
SCO57_0.86_0.8	0.28	13.24	4778.64	-5.45	40.97	0.819
SCO58_0.86_0.85	0.35	2.85	805.37	-1.05	6.72	0.802

Table 31. Stochastic Dominance with Respect to a Function for Rankings of Program Net Indemnities for Alternative Levels of STAX and SCO Coverage on a Mississippi County, AR Non-Irrigated Cotton Farm

	Efficient Set Based on SDRF at	
	Upper RAC	**0.0011**
	Name	Level of Preference
1	STX45_0.9_0.	Most Preferred
2	STX40_0.9_0.	2nd Most Preferred
3	STX44_0.9_0.	3rd Most Preferred
4	STX39_0.9_0.	4th Most Preferred
5	STX43_0.9_0.	5th Most Preferred
6	STX35_0.9_0.	6th Most Preferred
7	STX38_0.9_0.	7th Most Preferred
8	STX42_0.9_0.	8th Most Preferred
9	STX50_0.9_0.	9th Most Preferred
10	STX34_0.9_0.	10th Most Preferred
11	STX37_0.9_0.	11th Most Preferred
12	STX49_0.9_0.	12th Most Preferred
13	STX41_0.9_0.	13th Most Preferred
14	STX33_0.9_0.	14th Most Preferred
15	STX36_0.9_0.	15th Most Preferred
16	STX48_0.9_0.	16th Most Preferred
17	STX32_0.9_0.	17th Most Preferred
18	STX47_0.9_0.	18th Most Preferred
19	STX31_0.9_0.	19th Most Preferred
20	STX46_0.9_0.	20th Most Preferred
21	STX30_0.85_(	21st Most Preferred
22	STX29_0.85_(	22nd Most Preferred
23	STX28_0.85_(	23rd Most Preferred
24	STX25_0.85_(	24th Most Preferred
25	STX27_0.85_(	25th Most Preferred
26	STX24_0.85_(	26th Most Preferred
27	STX26_0.85_(	27th Most Preferred
28	STX23_0.85_(	28th Most Preferred
29	STX22_0.85_(	29th Most Preferred
30	STX21_0.85_(	30th Most Preferred
31	STX20_0.85_(	31st Most Preferred
32	STX19_0.85_(	32nd Most Preferred
33	STX18_0.85_(	33rd Most Preferred
34	STX17_0.85_(	34th Most Preferred
35	STX16_0.85_(	35th Most Preferred
36	SCO58_0.86_(	36th Most Preferred
37	SCO57_0.86_(	37th Most Preferred
38	STX11_0.8_0.	38th Most Preferred
39	STX12_0.8_0.	39th Most Preferred
40	STX13_0.8_0.	40th Most Preferred
41	STX14_0.8_0.	41st Most Preferred
42	STX15_0.8_0.	42nd Most Preferred
43	STX1_0.75_0.	43rd Most Preferred
44	STX2_0.75_0.	44th Most Preferred
45	STX3_0.75_0.	45th Most Preferred
46	STX6_0.8_0.7	46th Most Preferred
47	STX4_0.75_0.	47th Most Preferred
48	STX7_0.8_0.7	48th Most Preferred
49	STX5_0.75_0.	49th Most Preferred
50	STX8_0.8_0.7	50th Most Preferred
51	STX9_0.8_0.7	51st Most Preferred
52	STX10_0.8_0.	52nd Most Preferred
53	SCO56_0.86_(	53rd Most Preferred
54	SCO55_0.86_(	54th Most Preferred
55	SCO54_0.86_(	55th Most Preferred
56	SCO53_0.86_(	56th Most Preferred
57	SCO52_0.86_(	57th Most Preferred
58	SCO51_0.86_(	Least Preferred

Figure 9. Stochastic Efficiency with Respect to a Function for Rankings of Program Net Indemnities for Alternative Levels of STAX and SCO Coverage on a Mississippi County, AR Non-Irrigated Cotton Farm



Basis Factor

Based on the data presented above it is difficult to discern how the basis factor affects program net indemnity. Two irrigated cotton farms (Crosby and Mississippi) were utilized to isolate the basis factor and determine the effect of the basis on the potential program net indemnity. The Crosby County irrigated farm (Texas) was simulated using the Arkansas stochastic price data, and the Mississippi County irrigated farm (Arkansas) was simulated using stochastic price data for Texas. By cross-referencing the pricing data this allows further analyses on how the basis affects the program net indemnity for a decision-maker.

Initially, all mean values for the selected Texas farm were positive, with a 53.7 percent probability or greater that the program net indemnity is greater than zero (positive) (Table 14). Once the Texas farm was simulated with Arkansas price data, all mean values for the program net indemnity mean were greatly reduced, with Scenario 51 even being negative (Table 32). The probability of receiving a positive program net indemnity was reduced significantly to 10.5 percent or better with the best probability being 50 percent (previously 88.3 percent) (Tables 14 and 32).

When the same process was conducted with the Arkansas farm and Texas price data, there was an increase in mean values for program net indemnity, as well as the probability of receiving a positive program net indemnity (Table 33). Previously, the largest mean value for the irrigated Arkansas farm received was $89.39/acre (Scenario 35) with probability of 72.6 percent of a positive program net indemnity (Table 28). With Texas price data, mean values are larger with the largest mean represented by

Scenario 35 ($159.94/acre) (Table 33). Additionally, the probability of receiving a program net indemnity for all scenarios is increased (refer to Tables 28 and 33). With the original price data all scenarios had a 31.8 percent probability or better of receiving a positive program net indemnity (Table 28), with the Texas prices the probability of a positive program net indemnity increases for all scenarios to 67.8 percent or better (Table 33).

The basis does have an effect on program net indemnity as shown in Tables 32 and 33. As Mississippi County, Arkansas is located near the exchange (approximately 60 miles), the basis is small and fluctuations on price have a relatively small affect. Whereas, Texas cotton is several hundred miles from the exchange with a relatively large basis. The basis factor in Texas makes significant shifts in price, and the magnitude of those shifts are better seen in the program net indemnity.

Table 32. Summary Statistics on the Basic Affect for Alternative Levels of STAX and SCO Coverage on an Irrigated Texas Cotton Farm

Variable	Mean	StDev	CV	Min	Max	Prob(x<0)
STX1_0.75_0.7	0.13	5.14	3892.65	-1.39	30.90	0.895
STX2_0.75_0.7	0.15	5.79	3796.08	-1.56	34.76	0.895
STX3_0.75_0.7	0.17	6.43	3721.10	-1.73	38.63	0.895
STX4_0.75_0.7	0.18	7.07	3862.20	-1.91	42.48	0.895
STX5_0.75_0.7	0.20	7.72	3795.00	-2.08	46.35	0.895
STX6_0.8_0.7	3.37	14.99	445.37	-3.05	61.52	0.813
STX7_0.8_0.7	3.79	16.86	445.24	-3.43	69.21	0.813
STX8_0.8_0.7	4.21	18.74	445.11	-3.81	76.91	0.813
STX9_0.8_0.7	4.63	20.61	445.02	-4.19	84.60	0.813
STX10_0.8_0.7	5.05	22.48	444.94	-4.57	92.29	0.813
STX11_0.8_0.75	3.23	10.77	333.15	-1.66	30.71	0.808
STX12_0.8_0.75	3.63	12.12	333.38	-1.87	34.55	0.808
STX13_0.8_0.75	4.04	13.46	333.56	-2.08	38.38	0.808
STX14_0.8_0.75	4.44	14.81	333.72	-2.29	42.22	0.808
STX15_0.8_0.75	4.85	16.16	333.16	-2.49	46.06	0.808
STX16_0.85_0.7	10.07	26.28	261.08	-5.05	91.81	0.677
STX17_0.85_0.7	11.33	29.57	261.05	-5.68	103.29	0.677
STX18_0.85_0.7	12.59	32.85	261.03	-6.31	114.76	0.677
STX19_0.85_0.7	13.84	36.14	261.01	-6.94	126.24	0.677
STX20_0.85_0.7	15.10	39.42	261.00	-7.57	137.72	0.677
STX21_0.85_0.75	9.93	22.62	227.67	-3.66	61.08	0.667
STX22_0.85_0.75	11.17	25.44	227.72	-4.12	68.71	0.667
STX23_0.85_0.75	12.41	28.27	227.76	-4.58	76.34	0.667
STX24_0.85_0.75	13.66	31.10	227.62	-5.03	83.99	0.667
STX25_0.85_0.75	14.90	33.92	227.67	-5.49	91.62	0.667
STX26_0.85_0.8	6.70	13.13	195.97	-2.00	30.37	0.654
STX27_0.85_0.8	7.54	14.77	195.97	-2.25	34.17	0.654
STX28_0.85_0.8	8.38	16.41	195.97	-2.50	37.96	0.654
STX29_0.85_0.8	9.21	18.06	195.97	-2.75	41.76	0.654
STX30_0.85_0.8	10.05	19.70	195.97	-3.00	45.55	0.654
STX31_0.9_0.7	21.41	37.90	177.00	-7.35	121.80	0.524
STX32_0.9_0.7	24.09	42.64	177.01	-8.27	137.02	0.524
STX33_0.9_0.7	26.77	47.38	177.01	-9.19	152.24	0.524
STX34_0.9_0.7	29.44	52.12	177.02	-10.11	167.47	0.524
STX35_0.9_0.7	32.12	56.85	177.03	-11.03	182.69	0.524
STX36_0.9_0.75	21.27	34.67	162.98	-5.97	91.14	0.511
STX37_0.9_0.75	23.94	39.00	162.94	-6.71	102.54	0.511
STX38_0.9_0.75	26.59	43.34	162.96	-7.46	113.93	0.511
STX39_0.9_0.75	29.26	47.67	162.93	-8.20	125.33	0.511
STX40_0.9_0.75	31.91	52.00	162.96	-8.95	136.71	0.511
STX41_0.9_0.8	18.05	26.24	145.37	-4.30	60.44	0.503
STX42_0.9_0.8	20.30	29.52	145.38	-4.84	67.99	0.503
STX43_0.9_0.8	22.56	32.80	145.40	-5.38	75.54	0.503
STX44_0.9_0.8	24.81	36.08	145.41	-5.92	83.10	0.503
STX45_0.9_0.8	27.07	39.36	145.37	-6.45	90.66	0.503
STX46_0.9_0.85	11.35	14.54	128.15	-2.30	30.07	0.491
STX47_0.9_0.85	12.76	16.36	128.18	-2.59	33.83	0.491
STX48_0.9_0.85	14.18	18.18	128.20	-2.88	37.58	0.491
STX49_0.9_0.85	15.60	20.00	128.21	-3.17	41.34	0.491
STX50_0.9_0.85	17.01	21.81	128.23	-3.46	45.09	0.491
SCO51_0.86_0.5	-0.72	28.39	-3917.12	-18.80	73.82	0.692
SCO52_0.86_0.55	0.91	28.39	3136.47	-17.17	75.45	0.687
SCO53_0.86_0.6	2.82	28.39	1008.50	-15.26	77.36	0.679
SCO54_0.86_0.65	4.64	28.39	612.51	-13.44	79.18	0.673
SCO55_0.86_0.7	6.88	28.37	412.00	-11.18	81.44	0.662
SCO56_0.86_0.75	8.29	25.37	306.15	-8.36	73.02	0.650
SCO57_0.86_0.8	6.81	16.64	244.35	-4.97	43.91	0.637
SCO58_0.86_0.85	1.67	3.25	194.92	-0.90	7.52	0.602

Table 33. Summary Statistics on the Basic Affect for Alternative Levels of STAX and SCO Coverage on an Irrigated Arkansas Cotton Farm

Variable	Mean	StDev	CV	Min	Max	Prob(x<0)
STX1_0.75_0.7	19.66	17.27	87.82	-1.39	44.20	0.323
STX2_0.75_0.7	22.12	19.43	87.81	-1.56	49.73	0.323
STX3_0.75_0.7	24.59	21.59	87.79	-1.73	55.26	0.323
STX4_0.75_0.7	27.04	23.74	87.82	-1.91	60.78	0.323
STX5_0.75_0.7	29.50	25.90	87.80	-2.08	66.31	0.323
STX6_0.8_0.7	45.83	29.81	65.04	-3.05	88.13	0.154
STX7_0.8_0.7	51.55	33.53	65.04	-3.43	99.15	0.154
STX8_0.8_0.7	57.28	37.26	65.04	-3.81	110.17	0.154
STX9_0.8_0.7	63.01	40.98	65.04	-4.19	121.19	0.154
STX10_0.8_0.7	68.74	44.71	65.04	-4.57	132.21	0.154
STX11_0.8_0.75	26.16	14.09	53.85	-1.66	43.93	0.146
STX12_0.8_0.75	29.43	15.85	53.86	-1.87	49.42	0.146
STX13_0.8_0.75	32.70	17.61	53.86	-2.08	54.91	0.146
STX14_0.8_0.75	35.97	19.37	53.86	-2.29	60.40	0.146
STX15_0.8_0.75	39.24	21.13	53.85	-2.49	65.90	0.146
STX16_0.85_0.7	75.54	38.04	50.35	-5.05	131.73	0.066
STX17_0.85_0.7	84.99	42.79	50.35	-5.68	148.19	0.066
STX18_0.85_0.7	94.43	47.54	50.35	-6.31	164.66	0.066
STX19_0.85_0.7	103.88	52.30	50.35	-6.94	181.13	0.066
STX20_0.85_0.7	113.32	57.05	50.35	-7.57	197.60	0.066
STX21_0.85_0.75	55.88	23.01	41.18	-3.66	87.52	0.065
STX22_0.85_0.75	62.86	25.89	41.18	-4.12	98.46	0.065
STX23_0.85_0.75	69.85	28.77	41.19	-4.58	109.40	0.065
STX24_0.85_0.75	76.84	31.64	41.18	-5.03	120.35	0.065
STX25_0.85_0.75	83.82	34.52	41.18	-5.49	131.29	0.065
STX26_0.85_0.8	29.72	9.95	33.47	-2.00	43.59	0.061
STX27_0.85_0.8	33.43	11.19	33.47	-2.25	49.04	0.061
STX28_0.85_0.8	37.15	12.43	33.47	-2.50	54.49	0.060
STX29_0.85_0.8	40.86	13.68	33.47	-2.75	59.94	0.060
STX30_0.85_0.8	44.58	14.92	33.47	-3.00	65.39	0.061
STX31_0.9_0.7	106.63	43.67	40.95	-7.35	175.02	0.021
STX32_0.9_0.7	119.96	49.13	40.96	-8.27	196.90	0.021
STX33_0.9_0.7	133.28	54.59	40.96	-9.19	218.77	0.021
STX34_0.9_0.7	146.61	60.05	40.96	-10.11	240.65	0.021
STX35_0.9_0.7	159.94	65.50	40.96	-11.03	262.52	0.021
STX36_0.9_0.75	86.96	28.86	33.19	-5.97	130.81	0.020
STX37_0.9_0.75	97.83	32.47	33.19	-6.71	147.16	0.020
STX38_0.9_0.75	108.70	36.08	33.19	-7.46	163.51	0.020
STX39_0.9_0.75	119.57	39.68	33.19	-8.20	179.87	0.020
STX40_0.9_0.75	130.44	43.29	33.19	-8.95	196.22	0.020
STX41_0.9_0.8	60.80	16.21	26.66	-4.30	86.88	0.019
STX42_0.9_0.8	68.40	18.24	26.66	-4.84	97.74	0.019
STX43_0.9_0.8	76.00	20.27	26.67	-5.38	108.60	0.019
STX44_0.9_0.8	83.60	22.29	26.67	-5.92	119.46	0.019
STX45_0.9_0.8	91.21	24.32	26.66	-6.45	130.33	0.019
STX46_0.9_0.85	31.08	6.82	21.93	-2.30	43.29	0.019
STX47_0.9_0.85	34.97	7.67	21.93	-2.59	48.70	0.019
STX48_0.9_0.85	38.85	8.52	21.94	-2.88	54.11	0.019
STX49_0.9_0.85	42.73	9.37	21.94	-3.17	59.52	0.019
STX50_0.9_0.85	46.62	10.23	21.94	-3.46	64.93	0.019
SCO51_0.86_0.5	120.72	91.17	75.52	-18.80	370.67	0.069
SCO52_0.86_0.55	120.80	87.68	72.58	-17.17	318.21	0.068
SCO53_0.86_0.6	117.61	78.81	67.00	-15.26	266.03	0.067
SCO54_0.86_0.65	108.45	64.29	59.28	-13.44	213.75	0.067
SCO55_0.86_0.7	93.14	46.65	50.08	-11.18	161.92	0.064
SCO56_0.86_0.75	70.83	28.95	40.88	-8.36	110.65	0.056
SCO57_0.86_0.8	40.92	13.61	33.25	-4.97	59.94	0.053
SCO58_0.86_0.85	6.98	1.99	28.49	-0.90	9.92	0.046

CHAPTER V

SUMMARY AND CONCLUSION

Summary of Research

Risk management tools for producers have evolved over the decades. The farm bill, the common name for the legislation responsible for agriculture reforms, has provided various tools throughout the years to producers for managing risk and uncertainty. Previously, management tools were received in various ways, but were set based on cause and effect actions primarily based on the market. The Agriculture Act of 2014 (2014 Farm Bill) was developed with the intent to continue providing aid to producers, but at the same time reduce direct assistance from the federal budget.

To achieve the goal of the 2014 Farm Bill, many programs (direct payments, counter-cyclical payments, and ACRE) that relied on market trends or direct assistance were replaced with other types of risk management tools. Two new programs in the 2014 Farm Bill included STAX and SCO. Upland cotton producers can now elect between STAX and SCO as risk management tools, they cannot elect both; it must be one or the other. Both programs, STAX and SCO, are considered companion insurance programs because a producer will buy their individual insurance for their cotton crop, and can elect to enroll in either program for additional coverage. By electing to enroll in either program the producer receives additional coverage to indemnify their remaining liability at a subsidized rate. STAX has a premium subsidy of 80 percent and SCO has a premium subsidy of 65 percent.

STAX and SCO are new programs to the farm bill, therefore, there is no real data regarding the performance history of the program and very limited guidance to producers on how the programs aid to manage risk. Texas is the largest upland cotton producing state in the U.S., and producers in the region will want to understand how the two programs can manage risk. Producers in Texas face a unique challenge because farm yields are not homogeneous to county yields, as in the mid-west. Additionally, there is very little literature in crop insurance related to Texas and its primary crop of cotton. The objective of the research in this study was to better understand the risk management strategies that an upland cotton producer will face in determining whether to elect STAX or SCO.

To conduct the research, a simulation model was built using the Excel add-in Simetar©. Data for the model were collected from various sources: NASS, AFPC representative farms, futures market, and FAPRI. The data were further refined based on production practice – irrigated and non-irrigated. Summary statistics and simple trend regressions were calculated for each variable. A MVEMP distribution was used to calculate the parameters for simulating yields and prices. Using a correlation matrix of residuals from mean or trend generated from the MVEMP distribution and a vector of independent uniform deviates, an array of CUSDs was simulated by Simetar©. Validation of the simulated random numbers was completed using statistical hypothesis tests in Simetar©. Fifty-eight scenarios were developed based on the STAX and SCO parameters to analyze the optimal rate of additional coverage for a producer. Once the scenarios were simulated, two methods were used to rank the scenarios based on risk preference - SDRF and SERF.

Summary of Results

Texas Irrigated Farms

On average, irrigated cotton farms in Texas received higher mean values for a positive program net indemnity than the non-irrigated farms. This was expected because of the higher value for irrigated crop production. All STAX and SCO scenarios had zero probabilities of receiving a negative program net indemnity, indicating a positive program net indemnity. For each of the three counties analyzed in Texas with irrigated cotton farms (Crosby, Dawson, and Moore), Scenario 35 (STAX loss threshold of 90 percent and a companion coverage of 70 percent) had the largest mean value for program net indemnity. The smallest mean values were observed for Scenarios 1 and 58 (STAX loss threshold of 75 percent and a companion coverage of 70 percent scenarios and SCO loss threshold of 86 percent and a companion coverage of 85 percent, respectively) for the three counties. The range of mean values of program net indemnity do vary from county to county, but as revenue is a function of price and yield this is to be expected. Yields vary considerably in Texas from farm to farm, making an area-wide insurance plan interesting for places with low homogeneous yields.

Risk ranking preferences for the three counties were similar. Two scenarios (35 and 34), both scenarios have a STAX loss threshold of 90 percent and a companion coverage of 70 percent (the difference in coverage lies in their STAX Factor) were consistently ranked at the top by SDRF, with little change in the preference by decision-makers who are more risk averse than a normal person. SERF ranked Scenario 35 as most preferred for all risk averse decision-makers for all three irrigated production practices in Texas.

Texas Non-Irrigated Farms

Four counties from Texas with non-irrigated cotton production were analyzed – Crosby, Dawson, Moore, and Hill counties. Mean values for program net indemnity are lower than for irrigated cotton production, and many scenarios had negative mean values. The negative mean values indicate that on average the premium paid is greater than the indemnity received, resulting in a negative program net indemnity or no program payout to the producer. All non-irrigated cotton scenarios have non-zero probabilities that program net indemnity will be less than zero.

Risk ranking preferences for non-irrigated cotton production were similar to those observed in irrigated. Scenario 35 was preferred by all risk averse decision-makers. Scenario 35 is preferred by both production practices because it indemnifies the greatest amount of liability at a highly subsidized rate, with a lower and cheaper individual coverage.

Mississippi County, Arkansas Farm – Irrigated and Non-Irrigated

The representative farm from Mississippi County, Arkansas was included in the study to examine the effects of the basis, and comparison of the STAX and SCO programs from one state to another. Mississippi County is approximately 60 miles from Memphis, Tennessee – the spot price for cotton and location of the rule-making body for international cotton trading. With such a close proximity to Memphis, Mississippi County Arkansas has virtually a zero basis.

Program net indemnity for irrigated cotton in Mississippi County, AR has a mean of $74.74/acre and a minimum of -$3.37/acre. For all scenarios, the minimum values are negative and have non-zero probabilities of receiving a program net indemnity. Scenario 35 (STAX loss threshold of 90 percent and a companion coverage of 70 percent) is ranked most preferred by all risk averse decision-makers. As there is less price risk because of a zero basis, Scenario 51 (SCO) was a preferred scenario by SDRF and ranked in the top ten (Table 36). However, for an extremely risk averse decision-makers Scenario 51 was ranked at the bottom by SERF.

Mean program net indemnities for non-irrigated cotton were significantly lower, ranging from a low of -$29.12/acre to a high of $11.22/acre. Moreover, non-irrigated cotton production had much larger probabilities of program net indemnity being negative. Scenario 35 had the greatest probability of returning a positive program net indemnity at 42.6 percent. Similar to irrigated production, Scenario 35 was most preferred by risk averse decision-makers. Again, as in irrigated production SCO did deliver strategies that were preferred for risk management. Scenarios 51 and 52 (SCO loss threshold of 86 percent and a companion coverage of 50 and 55 percent, respectively) were ranked in the top ten by SDRF, but were ranked in the bottom five strategies by SERF.

Texas vs. Arkansas

Comparing Texas representative cotton farms to the selected Arkansas representative cotton farm the mean values are similar. All have probabilities that program net indemnities will be less than zero for a given scenario, however, Texas farms received higher probabilities of a positive program net indemnity than Arkansas from STAX and SCO. This is the result of two factors – yield variability and the basis (futures minus cash).

The disparity in yields makes an area-wide program difficult for programs based on area-wide yield triggers. For example, an effective Texas cotton producer may receive their expected yield, but the county did incur yield losses and as a county the cotton crop is less than the expected county historical yield. This county loss triggers a payment for all, regardless of need. The example could justifiably be reversed, a producer qualifies for an indemnity but the county does not. Whereas, in Mississippi County, Arkansas, the farm and county data are more closely related, therefore, indemnities are paid on a truer account of yield data.

The basis of the futures market does make a difference in the mean value and probability of receiving a program net indemnity. Mississippi County, Arkansas has little difference between the futures price and spot price because of its proximity to the delivery point to the Memphis Cotton Exchange. The small basis gives some protection to Arkansas producers, making price less risky on a day to day basis. This is not to say the market is not risky and the producer does not incur risk because a decline in the market would affect revenue, but less than those producers who have a larger basis.

Texas producers have a large basis (relatively), and the sharp changes greatly impact the insured price of cotton.

Conclusions

Several general conclusions can be drawn from the research project:

- Irrigated cotton production receives higher program net indemnities than non-irrigated due to irrigated cotton being a higher valued crop with larger program returns;
- For irrigated and non-irrigated decision-makers, Scenarios 31 – 35 (STAX loss threshold of 90 percent and a companion coverage of 70 percent with the differentiation of the scenarios being their respective STAX Factor) are preferred because of their larger mean values and probabilities of a positive program net indemnity;
- STAX is preferred more often than SCO;
- SCO is not a preferred risk management strategy because of its high premiums and inability to adequately indemnify remaining liability, except in regions where price variability is less risky because of the basis rate, or the county and farm yields are highly correlated;
- Texas farms received higher probabilities of a positive indemnity more frequently than Arkansas from STAX and SCO;
- Decision-makers benefit in purchasing a higher STAX factor (1.2 compared to 0.8 or 1.0) because of the cascading affect, and;

- Decision-makers prefer to purchase the lowest and cheaper individual coverage, and add to that coverage the STAX or SCO policy that indemnifies the greatest liability range allowed by a program.

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